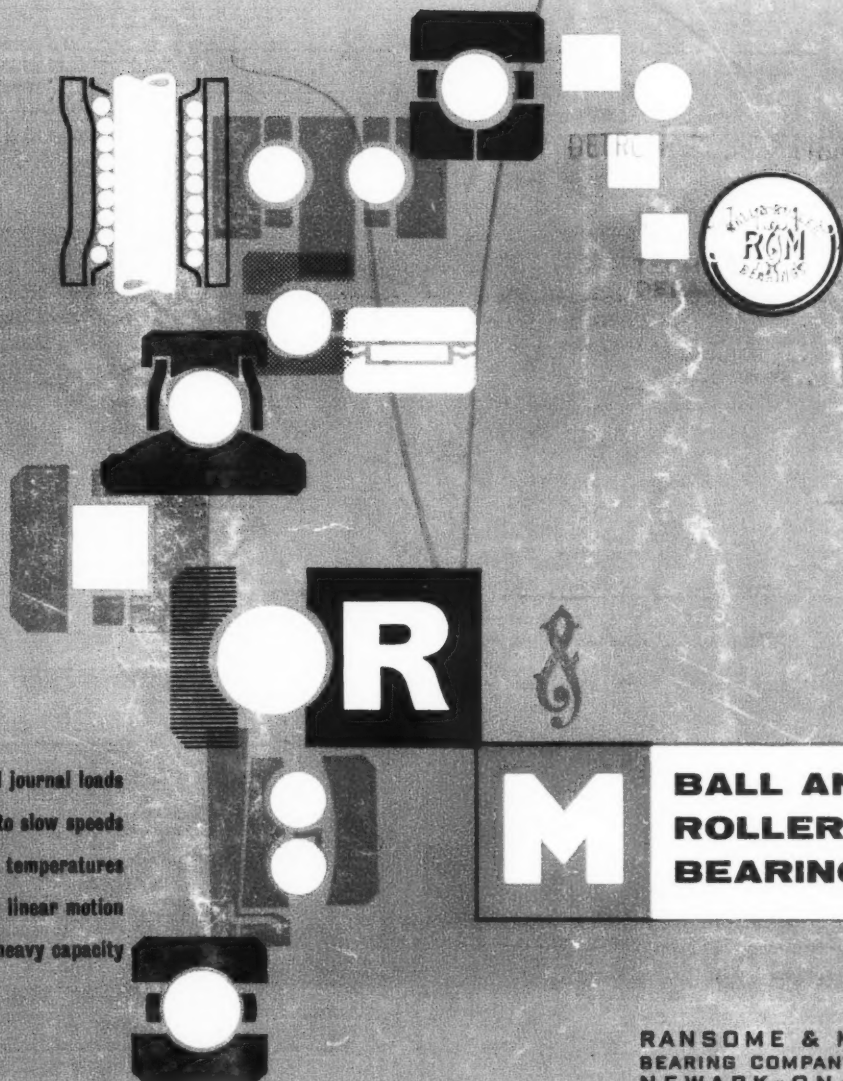


MACHINERY

MARCH 1, 1961

ONE SHILLING & THREEPENCE



Thrust and journal loads

Fast to slow speeds

High to low temperatures

Rotary or linear motion

Light to heavy capacity

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**BALL AND
ROLLER
BEARINGS**

**RANSOME & MARLES
BEARING COMPANY LIMITED
NEWARK-ON-TRENT**

MILLS grooved pins



NO REAMING
NO TAPPING
DRILL AND DRIVE HOME!

**12 different types
to suit all needs**

EXORS. OF JAMES MILLS LTD.

**BREDBURY STEEL WORKS
WOODLEY. NR. STOCKPORT**

Telephone: WOODLEY 2231. (10 lines) Telegrams: "MILLS" PHONE WOODLEY

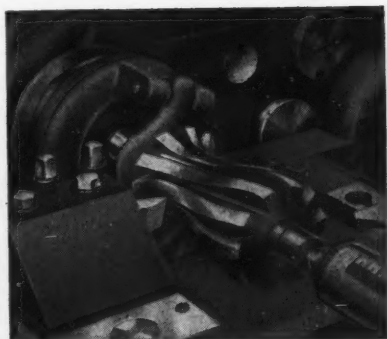
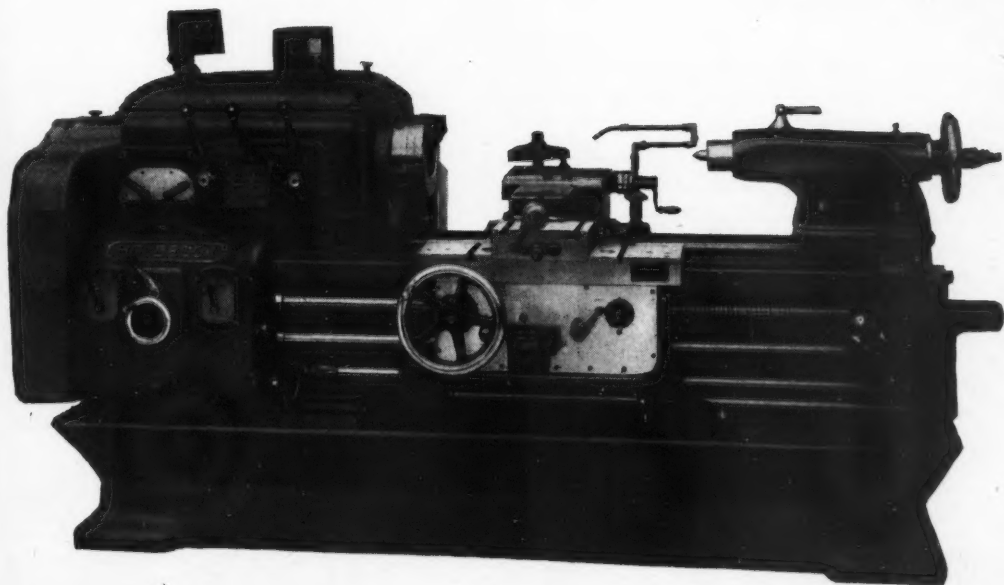
March 1, 1961

MACHINERY

1

MODEL 'R'

UNIVERSAL RELIEVING LATHES



BUILT IN TWO SIZES, FOR RELIEVING AND
GRINDING CUTTERS UP TO 4" AND 9" DIAMETER

FEATURES INCLUDE

PRECISION LEADSCREW WITH
COMPENSATING END THRUST

VARIABLE RISE CAM

3 TO 1, QUICK RETURN OF CARRIAGE
IN EITHER DIRECTION

REAR OPERATION, FOR LEFT HAND WORK

HOLBROOK
MACHINE TOOL CO. LTD.

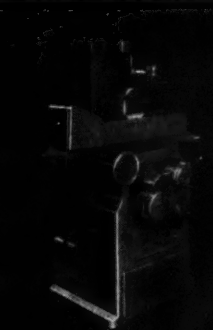
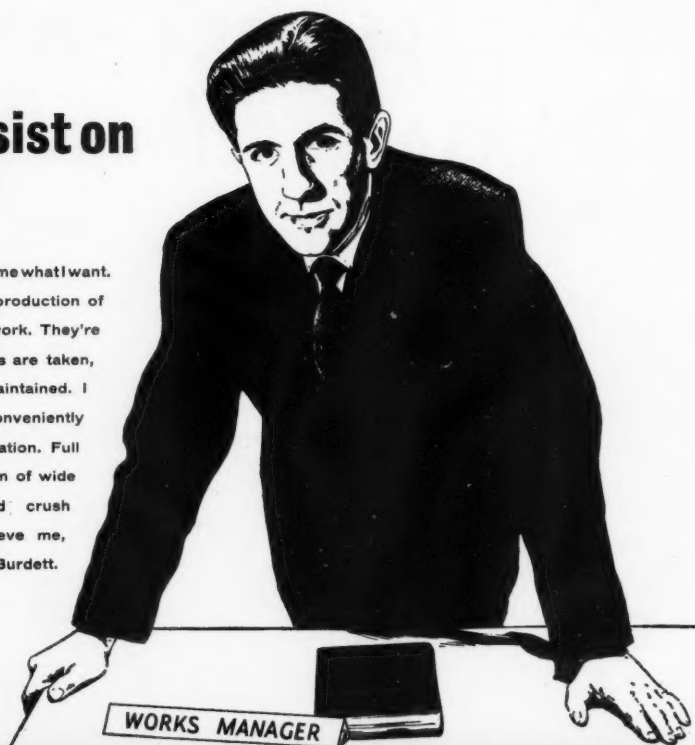
STRATFORD, LONDON AND HARLOW, ESSEX

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A

Why did I insist on Burdett's?

Practical experience! They give me what I want. High output and trouble-free production of first-class quality precision work. They're sturdy: even when heavy cuts are taken, accuracy and quality are maintained. I like the way controls are conveniently centralized for easy manipulation. Full advantage, too, can be taken of wide wheels on forming and crush grinding techniques. Believe me, there are no worries with Burdett.



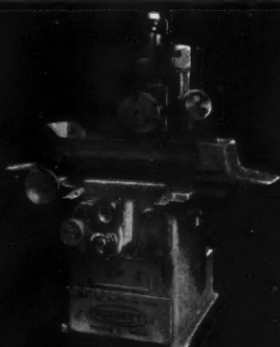
MODEL 70. 18 x 6.

Acknowledged to be the most powerful 18 x 6 Surface Grinder made. Capable of the heaviest stock removal and at the same time, the best possible surface finish and the highest accuracy.



MODEL 75. 24 x 8.

Heavy cuts will not disturb the settings of the specially designed spindle and bearings. All working parts fully protected and serviced with ease.



MODEL 77. 24 x 12.

Latest addition to the range. Has all the features of the other models plus extra grinding width for dies and press tools.

G.W.S. BURDETT & CO. LTD.
EAST GATE PETERBOROUGH

Telephone 4871

When answering advertisements kindly mention MACHINERY.



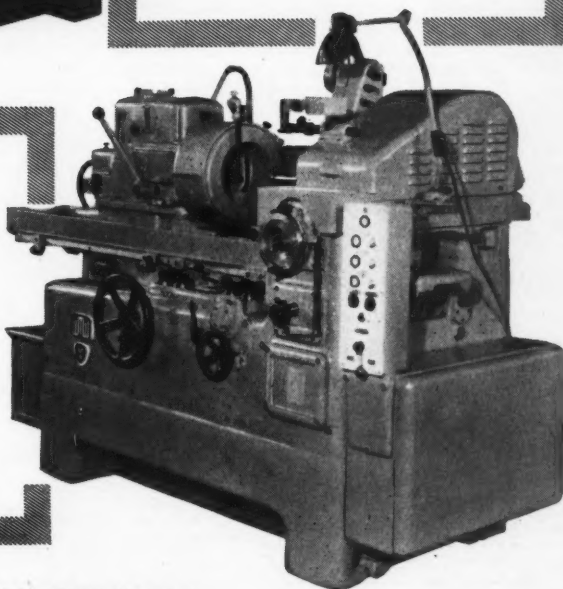
INTERNAL GRINDING MACHINES

Model SI.40 x 70

Capacity $\frac{5}{8}$ " — $1\frac{3}{16}$ "
x $2\frac{1}{2}$ ", can be supplied
with automatic measuring

Model SI.125 x 175

Capacity 1" — $4\frac{15}{16}$ " x
 $6\frac{7}{8}$ ", infinitely variable
hydraulic table traverse.



EARLY DELIVERY

ELGAR

EXCLUSIVE DISTRIBUTORS IN THE UNITED KINGDOM

MACHINE TOOL COMPANY LIMITED

172-178 VICTORIA ROAD : ACTON : LONDON W3 : Telephone ACORN 5555
MIDLANDS SHOWROOM: 1075 KINGSBURY ROAD, ERDINGTON, BIRMINGHAM 24. Tel: Castle Bromwich 3781/2
SOLE SCOTTISH AGENTS: ANGUS & CRICHTON (SALES) LTD., 7 MIDLAND STREET, GLASGOW C.I. TELEPHONE: CITY 4560
NRP 3404

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'ThermoSpray' hard-facing out-wears hardened steel by 3 to 10 times



Illustration shows 'ThermoSpray' Gun applying a hard, corrosion-resisting coating to a pump-shaft. This hard-facing gives a service life of 20 times that of an untreated stainless shaft.

Now anyone can apply these extremely hard corrosion-resistant coatings with close control of deposit thickness, by using the 'METCO' 'ThermoSpray' Gun. This, plus the smooth surface, reduces finishing costs to a minimum. High speed application and high deposit efficiency lower costs, making these tough durable surfaces economical for either one off or mass-produced parts.

The 'METCO' 'ThermoSpray' Gun is light in weight, can be hand-held or machine mounted, requires only oxygen and acetylene for its operation and set-up is quick and easy. Also sprays ceramics (alumina and zirconia), tungsten carbide and other metals in powder form.

Bulletin 126 gives full details. Please post coupon for your copy.

Registered User
of trade-marks

METCO LTD

'METCO' and
'ThermoSpray'

FORMERLY: METALLIZING EQUIPMENT COMPANY LIMITED

CHOBHAM · WOKING · ENGLAND

TEL: CHOBHAM (WOKING) 590

FLAME SPRAY EQUIPMENT AND SUPPLIES

METCO LTD

Chobham · Woking · England
Please send me a copy of
Bulletin 126

NAME _____

COMPANY _____

ADDRESS _____

E12

When answering advertisements kindly mention MACHINERY.



MODEL HSS 33 B

Automatic Worm Grinding Machine enables you to obtain the increased efficiency, longer life and higher load capacity which result from the use of hardened and precision ground worms.

Single or multi-start worms, in a wide range of size and pitch can be economically produced to an exceptionally high standard of accuracy and finish.

The redesigned wheel dresser employs a single sided template to profile both sides of the wheel simultaneously with mirror-image accuracy. Extreme flexibility in operation is an important feature of Model HSS 33 B; the workpiece can be machined during both forward and reverse strokes and the two flanks may be ground simultaneously or individually.

BRIEF SPECIFICATION

Workpiece diameter	From $\frac{1}{8}$ in. to 12 $\frac{1}{2}$ in.
Pitch range	1 to 50 D.P.
Number of starts	1 to 10
Max. Lead angle	40°
Lead range (4 T.P.I. Leadscrew)	$\frac{1}{8}$ in. to 10 in.
Lead range (2 T.P.I. Leadscrew)	$\frac{1}{4}$ in. to 20 in.
Max. Length:	
Worms between centres	28 $\frac{1}{2}$ in.
Shaft worms (up to 3 $\frac{1}{2}$ in. shank diameter)	43 $\frac{1}{2}$ in.
Max. Length ground:	
up to 30° lead angle	17 $\frac{1}{2}$ in.
up to 40° lead angle	16 $\frac{1}{2}$ in.

The capacities given above for Lead and number of starts can, in certain cases, be increased.

Fully detailed information available on request.



SOLE BRITISH AGENTS

SYKES

MACHINE TOOL COMPANY LIMITED

Hythe Works, The Hythe, Staines, Middlesex. Telephone Staines 55474 (5 lines) Telegrams Syftool Staines

For PRODUCTION Jig Boring



SWISS

OERLIKON

PRODUCTION JIG BORER MODEL R 2

With bridged double columns for extra rigidity this heavy duty machine combines rapid production with high precision. Positioning is automatic by easily stored punched cards or tape. Co-ordinate settings can be made by dials also. The quill head locks electrically. The outer column moves through an arc for loading heavy work and the long backward traverse permits it to be mounted low down on the front face of the table, providing extra working height. Many special tools are available for turning, milling, facing, tapping.

Send for
illustrated brochure M/206 to
Sole U.K. Distributors

*Drilling capacity $2\frac{3}{16}$ " in c.i. Spindle speeds (18) 38 to 1900 r.p.m.
Table traverse $42\frac{1}{2}$ "*



DOWDING & DOLL LTD

346 KENSINGTON HIGH STREET, LONDON, W.14

Tel: WESTERN 8077 (8 lines) Telex: 23182 Grams. ACCURATOOL LONDON TELEX

206

When answering advertisements kindly mention MACHINERY.

**For High Rates of
Stock
Removal**



INNOVATION

PRODUCTION LATHE MODEL T5 with BRÈCHE single-point Thread Chasing Attachment

Robust, built with meticulous care by craftsmen, this machine has a remarkable capacity for stock removal. Bed and base form a rigid unit. The spindle is mounted in 3 precision Gamet bearings. Carriage and cross-slide are unusually robust permitting multiple carbide tooling to be used both front and rear. Quick-acting micrometer cross-traverse stops are provided, and for the longitudinal motion also. With the BRÈCHE single-point Thread Chasing Attachment external, internal and taper screwcutting can be performed exceedingly rapidly.

Swing over bed 13½". Centre distance 21½". Spindle speeds (9) 180 to 2800 r.p.m.

MODEL T6: Swing over bed 17½". Centre distance 27½". Spindle speeds (12) 45 to 2000 r.p.m.

See the T5 machine at our Showrooms or send for brochure M/193 to Sole U.K. Distributors



DOWDING & DOLL LTD

346 KENSINGTON HIGH STREET, LONDON, W.14

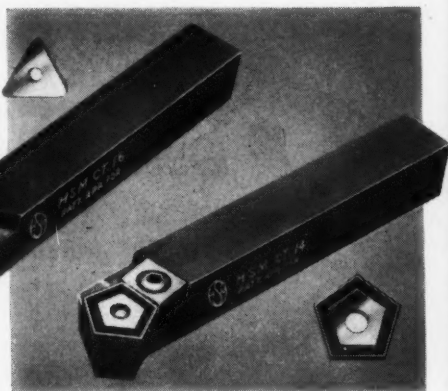
Tel: WESTERN 8077 (8 lines) Telex: 23182 Grams: ACCURATOOL LONDON TELEX

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Have YOU a tool grinding problem?...



Wejlock tools with Tungsten Carbide "throw-away" tips are the simple, effective answer. The tips have six or ten cutting edges and a worn edge may be changed in less than ten seconds. They entirely eliminate grinding and the need to reset after renewing a tool. If you have a cutting, pressing or excessive wear problem then our advice, based on over 25 years experience, is at your disposal.



Specify



BRAND

TUNGSTEN CARBIDE

Literature available on request.

Tungsten Carbide Tips, Lathe tools, Milling Cutters, Special Cutters, Special Reamers, Special Drills.

HIGHER SPEED METALS LTD
BROCCO STREET, SHEFFIELD 3. TELEPHONE 20318

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ALSO

SCH

New Small SCHÜTTE SIX SPINDLE AUTOMATIC

MODEL SE16

*INDEPENDENT CROSS & LONGITUDINAL
TOOL CARRIERS FOR EACH SPINDLE*

Designed for the high speed production of small components.

Spindle speeds up to 5000 rpm; piece times as short as 2 secs.

Individually positioned quills carry longitudinal tools.

Full accessibility for setting.

Easy swarf clearance without stopping machine.

Large number of special attachments.

Components can be machined on part-off side with pick-off attachment.

Heavy construction—net weight 4½ tons.

Fully automatic lubrication.

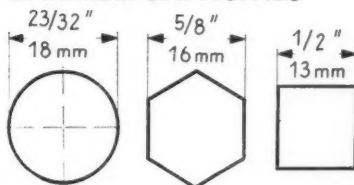
Automatic safety devices.



EARLY DELIVERY

Maximum Bar Feed	4½"
No. of Spindle Speeds	45
Range of Spindle Speeds	400 - 5000 rpm
Piece Times	2 - 45 secs.

MAXIMUM CAPACITIES



ROCKWELL
MACHINE TOOL CO. LTD.

For further particulars write or telephone TODAY

WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

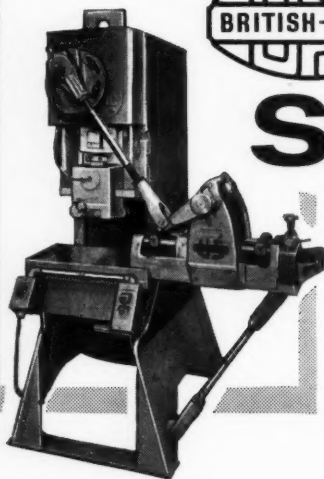
ALSO AT BIRMINGHAM—TEL: SPRINGFIELD 1134/5 • STOCKPORT—TEL: STOCKPORT 5241 • GLASGOW—TEL: MERRYLEE 2822

REDUCE SET-UP TIMES

with the improved



SLIDE FEED



EASE OF ADJUSTMENT

No connecting rod adjustments required when changing feed lengths.

SYMMETRICAL DESIGN

Feed block operates from centre. Front and rear stops adjustable.

FEED-LENGTH INDICATOR

Attached to feed body. Allows quick check of feed length. Eccentric is simply adjusted so that indicator points to desired length on scale.

MACHINED PAD ON SIDE BRACKET

for alignment with die.

SIMPLE ADJUSTMENT FOR STOCK THICKNESS

Model No.	Max. Width of Stock	Max. Length of Feed	Max. Stock Thickness
SF-68A	6"	8½"	⅛"
SF-99A	9"	9½"	⅜"

ROCKWELL
MACHINE TOOL CO. LTD.

For further particulars write or telephone TODAY

WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 8033

ALSO AT BIRMINGHAM—TEL: SPRINGFIELD 1134/5 • STOCKPORT—TEL: STOCKPORT 5241 • GLASGOW—TEL: MERRYLEE 2822

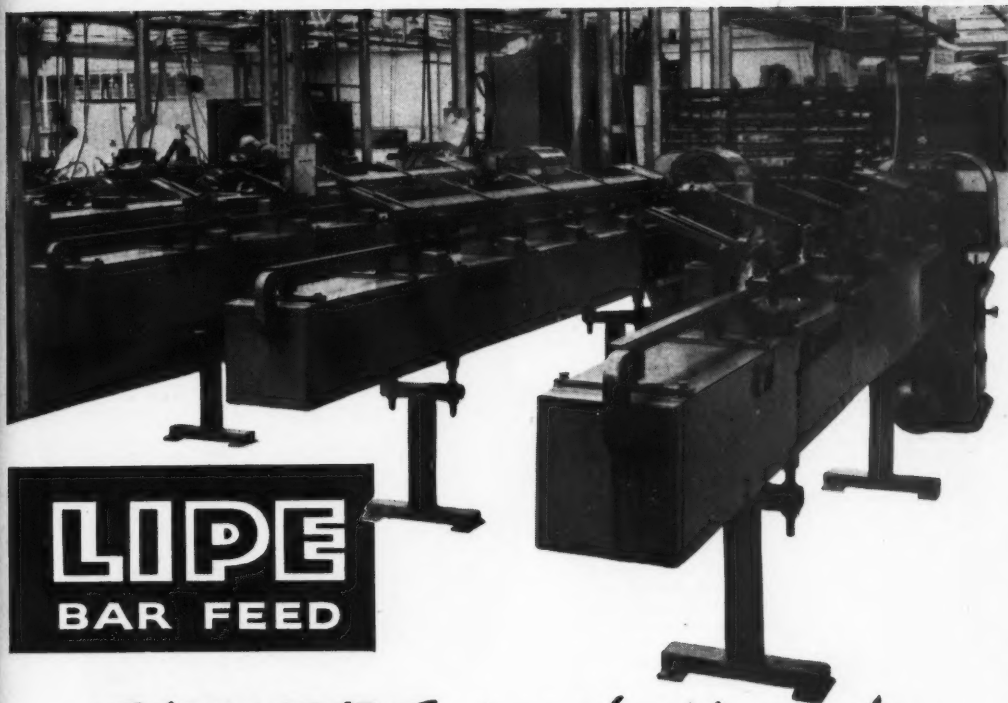
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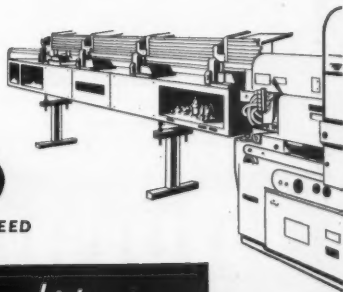
LIPE BAR FEED

SPEEDS production at...

This leading manufacturer works accurately and fast — that's why he uses Lipe Bar Feed with fully automatic loading, feeding and ejection.

NUCKEY, SCOTT & CO. LTD

- Reloading time cut to 4 seconds.
- Machine runs continuously — no time wasted.
- Absolutely reliable — one operator can handle several machines.
- 30% to 100% production increase.
- No feed fingers — feeds to LAST workpiece and ejects remnant automatically.
- There's a LIPE for most bar fed machines.
- Patented Rear Ejection gives positive control of remnant at all times.



LIPE ROLLWAY

FULLY AUTOMATIC MAGAZINE LOADING PNEUMATIC BAR FEED

Send for Data to Dept. M.3351
Patents Nos. 728898, 743461 and 827417

NAP 3351

Automation Ltd.

DEVONSHIRE HOUSE VICARAGE CRESCENT LONDON S W 11
PHONE BATTERSEA 5549

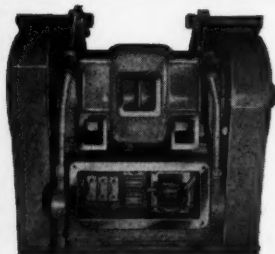
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THE NEW MURAD EG8 DUSTLESS GRINDER

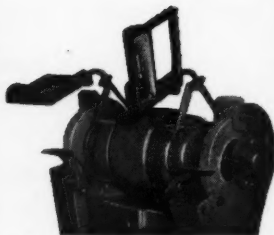
- Filter Resistance Halved
- Impeller Capacity Trebled
- Eye Shields and Local Lighting
- Now Standard

These are some of the many improvements embodied in the new EG.8 making it without question the best off-hand Grinder in the world. The Murad Dustless Grinder is unique. It embodies its own dust inhibitor which offers protection to both worker and employer and makes the provision of a separate dust extraction plant unnecessary. It can be placed anywhere in the shop to suit the sequence of operations, even in close proximity to precision machines without endangering their slides. The repeat order is the finest tribute that a customer can pay to the efficiency and reliability of a machine tool. Britain's industrial giants have paid this tribute to the Murad Dustless Grinder.

Amongst many Users who send us a constant stream of repeat orders are such world-famous firms as Mullards, Pressed Steel, G.E.C., Atomic Energy Authority, B.T.H., British Oxygen, Gillette Industries, Skefko, etc., etc.



Control switchgear is designed into the machine and not added as an afterthought.



The above illustration shows the eyeshield swung up for ease in changing lamps, etc.

Pat. No. 674748

MURAD DEVELOPMENTS LTD.

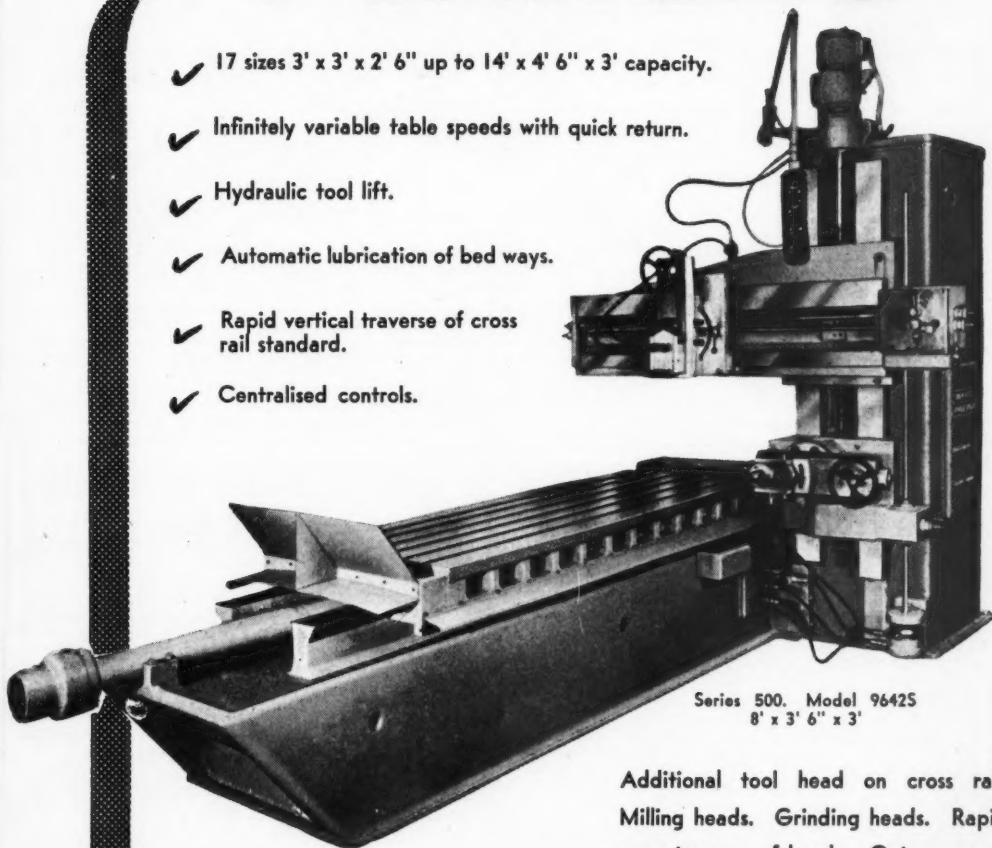
WHITEWAY • QUEENSBOROUGH • ISLE OF SHEPPEY • KENT

Telephone: SHEERNESS 3084

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INVICTA**HYDETS CO***Hydraulically Operated***PLANERS**

- ✓ 17 sizes 3' x 3' x 2' 6" up to 14' x 4' 6" x 3' capacity.
- ✓ Infinitely variable table speeds with quick return.
- ✓ Hydraulic tool lift.
- ✓ Automatic lubrication of bed ways.
- ✓ Rapid vertical traverse of cross rail standard.
- ✓ Centralised controls.



Series 500. Model 96425
8' x 3' 6" x 3'

Additional tool head on cross rail. Milling heads. Grinding heads. Rapid cross traverse of heads. Outer support for cross rail. Concertina guards for all ways are available to order. Double column machines available on request.

Manufactured by

B. ELLIOTT (MACHINERY) LTD.

(Member of the B. Elliott Group)

VICTORIA WORKS, WILLESDEN, LONDON, N.W.10

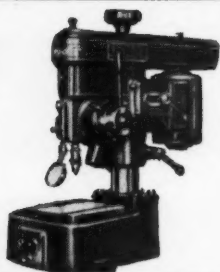
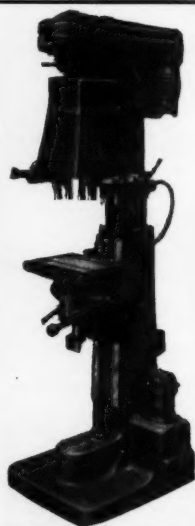
Telephone: ELGar 4050 (10 lines) Telegrams: Elliottona, Marles, London

Overseas Subsidiaries: CANADA, U.S.A., AUSTRALIA, S. AFRICA



NRP 2501

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ROSA DRILLING MACHINES

CAPACITIES FROM
1/4" to 2"

THE TWO POPULAR SIZES
SHOWN ARE
MODEL 3/1 1/4" CAPACITY
18,000 R.P.M. HIGH
PRECISION BENCH DRILL

MODEL MU.12 1 3/8" CAP
12 SPINDLE MULTI
DRILLING MACHINE
ALSO 8 SPINDLE 1/2" CAP

OVER 30 DIFFERENT OTHER
MODELS AVAILABLE
HIGHEST PRECISION

ASK ALSO FOR DETAILS
ON ROSA TAPPING
MACHINES 1/2" CAP

Sole Concessionaires

SCOT URQUHART LTD.

373a EARLSFIELD ROAD : LONDON S.W.18.

VANDYKE
5708/9



BIAX AMERICAN TYPE SUPER SENSITIVE TAPPING ATTACHMENTS

FOR GENERAL OR
PRODUCTION WORK

EXTRA SMOOTH
ACTION FRICTION
CLUTCH

AUTO
REVERSING

LIGHTWEIGHT

LOW COST

TRADE SUPPLIED

GS I 1/8" - 5/8" £29. 0

GS II 1/4" - 1/2" £38. 17

GS III 1/2" - 3/4" £40. 14

ATTACHMENTS LIKE THESE
ARE ON THE MARKET BUT AT
NOTHING LIKE THESE PRICES

BUY THE BIAX — BUY THE BEST

SCOT URQUHART LTD.

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VANDYKE
5708/9

THE 1961 ADVANCED TROGLIA TPS 8 LATHE WITH HIGH

* WITH REMOVABLE GAP-SWINGS 20ins.

* MODERN TO THE MINUTE !

67" x 40" & LOW SPEEDS



VAN 5708/9

373a EARLSFIELD ROAD, S.W.18

SOLE CONCESSIONAIRES

RPM 50 - 1460, 62 - 1825.
Auto Stop-Start-Reverse.
Auto Stop to Saddle.
Hardened & Ground
Gears — Whit Metric
and Modul Threads
Dial Type Norton Gear.
Box-Built-in Electrics.
Removable Suds Tray.
Weight 1,876 lbs.

DELIVERY — 6 WEEKS !
DEMONSTRATIONS IN OUR
SHOWROOMS NOW

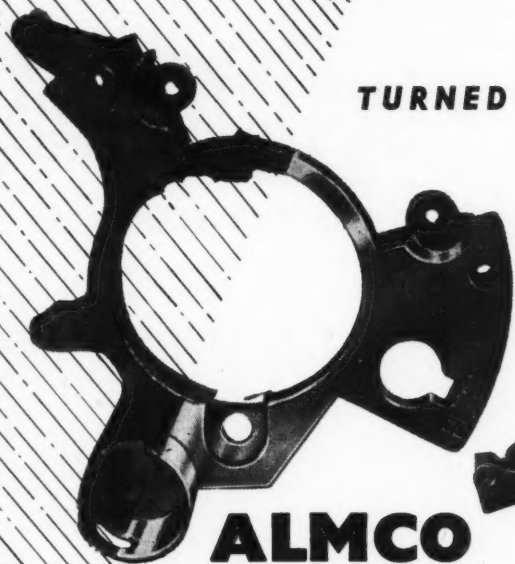
ALSO
8," 9," 10" and 12"
CENTRE MODELS

MOST ATTRACTIVE PRICES
SCOT



Limited

TURNED OUT FINE AGAIN...



ALMCO SPEED FINISHING GIVES THE SAME UNIFORM FINISH EVERY TIME . . . TEN TIMES FASTER

Using Almco Supersheen barrel-finishing equipment and materials, *unskilled* operators can turn out *precision* DEBURRING, DESCALING, BURNISHING, POLISHING, etc., with practically no rejects, with savings of up to 87%, at ten times the speed of hand-finishing.

To prove to yourself that such savings are realities, we invite you to send any unfinished component you choose to our development laboratory where it will be processed **FREE OF CHARGE**. Its finished appearance—together with the detailed report provided—will convince you that Almco products are *essential* in keeping pace with modern production methods.

Why not ask us to call? Or, better still, call and see your own products undergoing processing.

ALMCO

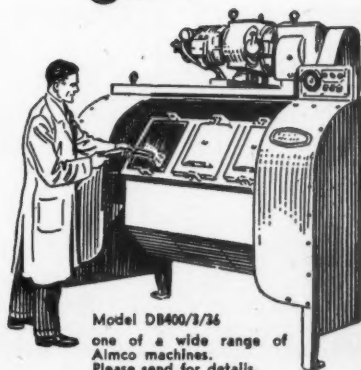
Supersheen

BURY MEAD WORKS · HITCHIN · HERTS

Telephone: Hitchin 3669

A Division of the King Seesley Corporation, Ann Arbor, Michigan, U.S.A.

U.S.A. Almco Division, Albert Lee, Minnesota. HOLLAND (Rotterdam) N.V. Technische Handelssonderneming "Carborundum Alexite" BELGIUM & LUXEMBURG (Bruxelles) Technimetal Societe Anonyme. SWEDEN (Stockholm) Trumlingsak-Tiebolaget. SWITZERLAND (St. Gallen) L. Keilenberger & Co. SOUTH AFRICA (Johannesburg) Barry Coine & Co. (Pty.) Ltd. AUSTRALIA & NEW ZEALAND (Melbourne) Hardie Trading Ltd.



Model DB400/3/36

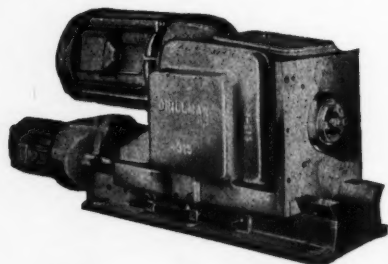
one of a wide range of Almco machines. Please send for details.

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DRILLMAX*A Complete Range of***STANDARD****... AUTOMATION EQUIPMENT**

This unique range of equipment has been continually developed over many years and has been proved in practice.

Drillmax Standard Equipment is now widely used throughout Britain and is obtainable in most countries of the World through our local agents.



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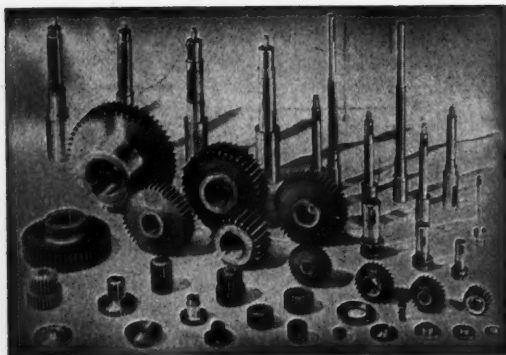


2



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6

- 1 Model S.15 Screw Feed Unit Head (one of 4 Models)
- 2 Model C. Minor cam Feed Unit Head
- 3 Automatic Index Tables (Models in 6 sizes)
- 4 Standard Multi-Head, Spindles, Gears, Spacers, etc.
- 5 Model V series Universally Adjustable Multi-Heads
- 6 Model M series Adjustable Centre Multi-Heads

Illustrated literature available upon request

Also available: Standard Wing Bases, Columns and Control Units.

PETER BRASSHOUSE LTD.

Drillmax Division, Leighswood Works, Leighswood Road, Aldridge, Staffs.

Telephone: Aldridge 52814-5.

When answering advertisements kindly mention MACHINERY.

the ultimate in **JIG GRINDING**

MOORE-CATMUR

**No. 2 PRECISION
JIG GRINDER**

**The craftsman's choice
—for high precision
and rapid stock
removal.**

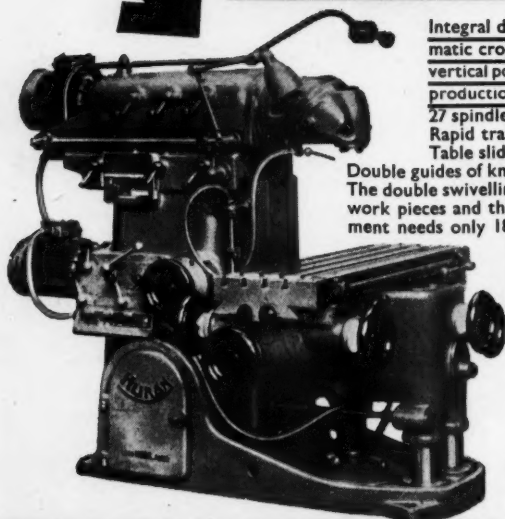
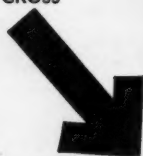
*The dust protective aprons have been
removed for the actual photograph.*



CATMUR

MACHINE TOOL CORPORATION LIMITED

SLIDING RAM
GIVES 27½ in.
AUTO CROSS
FEED



HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS

Integral double swivelling universal head provided with 27½ in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from ⅛ in. to 30 in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel.

Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14 in. to enter work pieces and the whole sliding ram with its 27½ in. automatic cross movement needs only 18 in. clearance. **OPTIONAL EXTRA FEATURES:** Mounted spacing casting assemblies providing additional 8 in. capacity under spindle. 26 in. wide 8 T-slot tables and 39½ in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

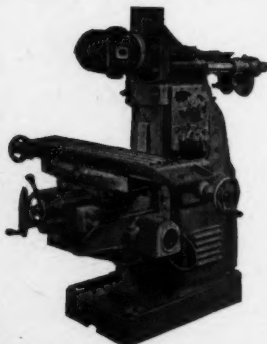
Type	Table	Automatic Feeds		
		Long	Cross	Vert.
KU4	56½ in. × 15½ in.	43½ in.	27½ in.	19½ in.
KU5	64½ in. × 15½ in.	51 in.	27½ in.	19½ in.
KU6	78½ in. × 16½ in.	59 in.	27½ in.	19½ in.
KU55	64½ in. × 26 in.	51 in.	39½ in.	18½ in.
L83	157 in. × 59 in.	118 in.	39½ in.	59 in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR
UNIVERSAL
MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING
HEAD, RETRACTABLE SLIDE BRACKET AND
SPACING CASTING GIVING 26" DAYLIGHT
ON No. 59 AND 21" ON No. 61

FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½ in. Spacing Casting Drive assembly on 59 Machine 26 in. daylight, and 21 in. on No. 61.

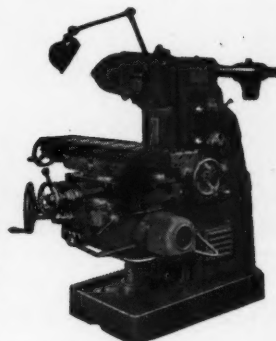


MODELS 53 & 61. 16 universal head spindle speeds

21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ⅛-18½ in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ⅛-20 in.

MODEL 54. Automatic cross feed of universal head 20 in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds ⅛-23½ in.



Type	Table	Automatic Feeds		
		Long	Cross	Vert.
53	43½ in. × 9 in.	27 in.	9 in.	15 in.
61	47½ in. × 10 in.	30 in.	9 in.	15 in.
59	51½ in. × 11 in.	34 in.	11 in.	21 in.
54	67 in. × 14 in.	43 in.	14 in.	20 in.

Send for full particulars of our very extensive range of these machines; ask for demonstration.

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Tel: CHISWICK 0514, 6585 & 0337. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON.

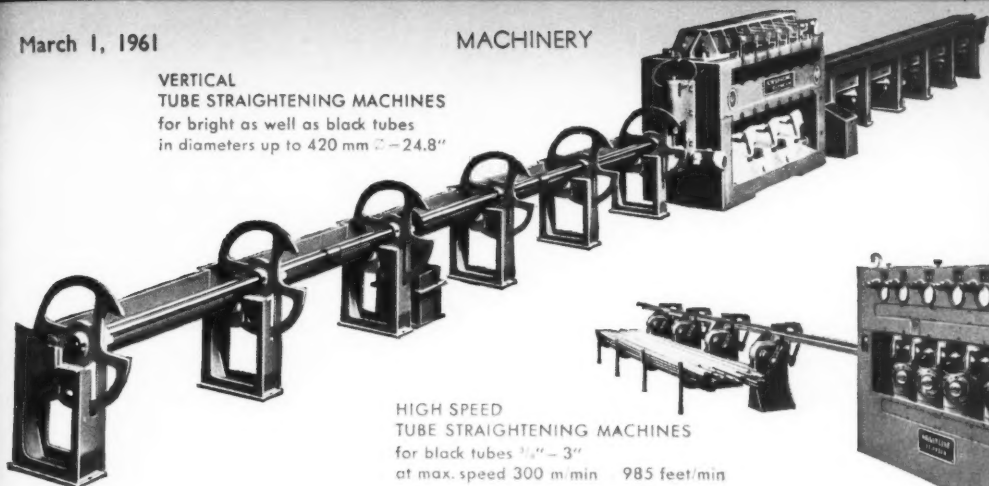
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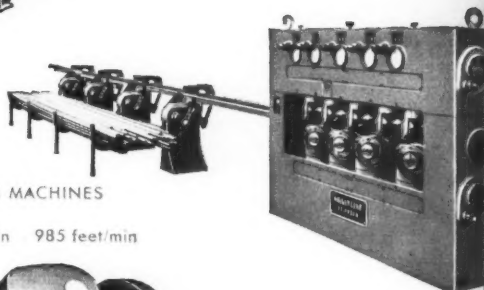
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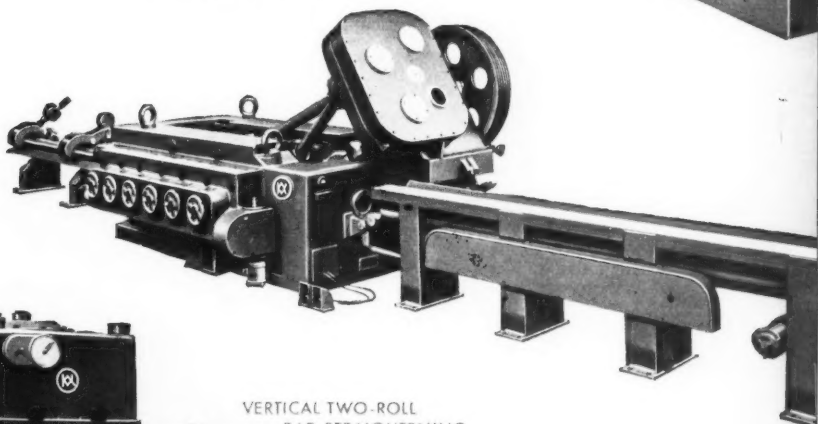
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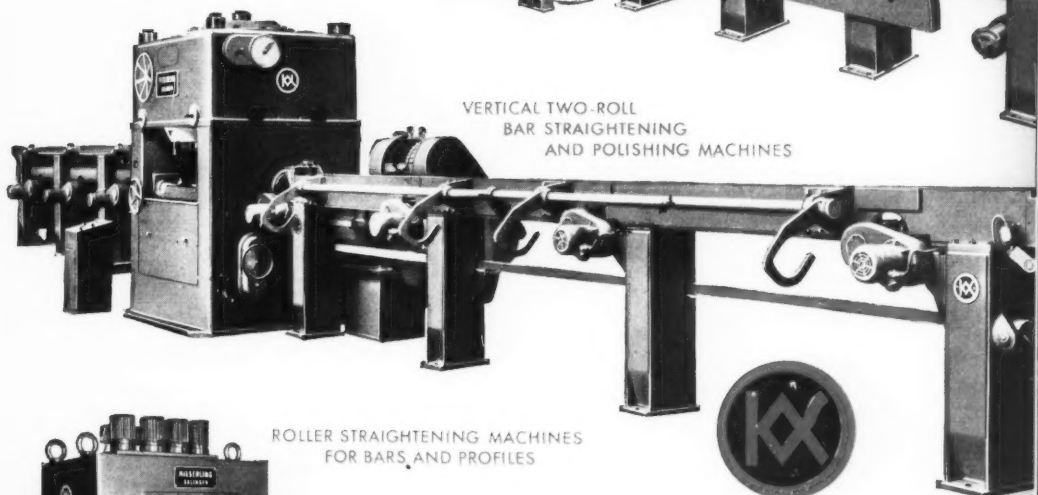
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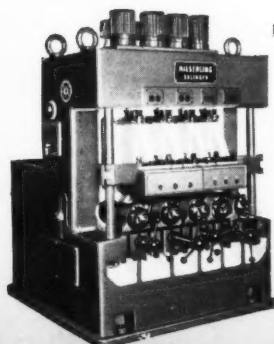
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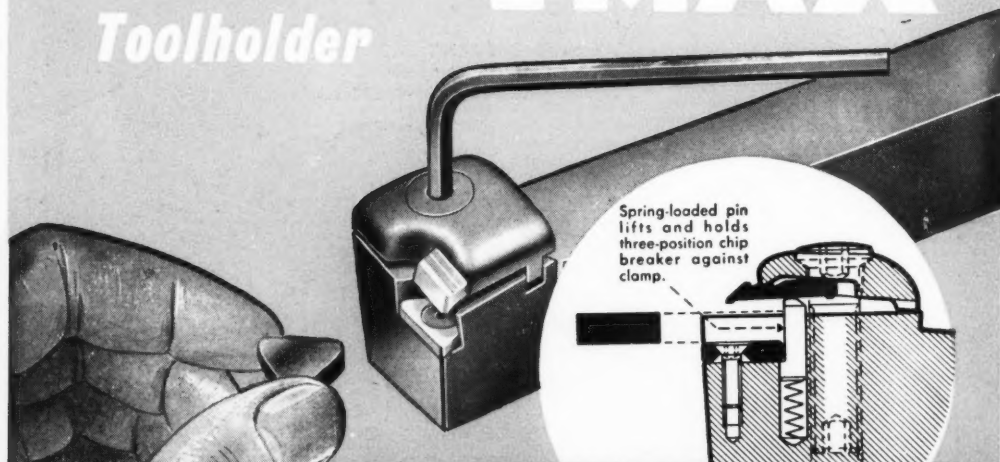
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GERMANY

The Fastest- Changing Toolholder

SANDVIK Coromant T-MAX



With the **EXCLUSIVE**
Spring Lifted Three Step Chipbreaker

Same Wrench
Operates Screw
from Top or
Bottom. Saves
Time on Multi-tool
Set-Up.



**NEW COROMANT
INSERT
DISPENSER**

Puts a new insert
at your finger-
tips. Calibrated
slot shows re-
maining inserts.

SEND FOR NEW
FREE BOOKLET

Covering various T-Max
styles and other
technical data.



Loosen, change, tighten—and you're back in production. It's as quick and easy as that with Coromant T-Max—fastest throwaway-type, carbide toolholder on the market.

Only T-Max enables you to change either or both the carbide cutting edge and depth of cut without removing or replacing chip breaker.

When set screw is loosened, a spring-loaded pin automatically lifts and holds chipbreaker against clamp—lets you change or index insert with no waste motion. When changing cut, a push with the wrench clicks the solid carbide chipbreaker into desired position for light, medium or heavy cut.

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- Precision cast, alloy steel clamp is streamlined for free chip flow.
- Low cost chipbreaker cuts replacement expense.

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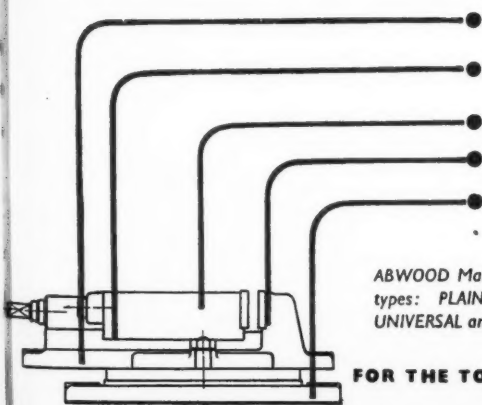
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SLIDING JAW MACHINED OVER ITS WHOLE SURFACE FOR THE USE OF THE SCRIBING BLOCK.

GROUND TOOL STEEL JAWS AND PHOSPHOR BRONZE NUT.

ACCURATELY MACHINE DIVIDED SWIVEL BASES INDEXED FULLY THROUGH 360.

ABWOOD Machine Vices are available in the following types: PLAIN, SWIVEL TYPE (illustrated), SHAPER, UNIVERSAL and UNIVERSAL COMPOUND ANGLE TABLE.

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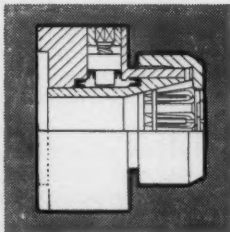
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The Crawford Multibore Collet grips many sizes accurately and powerfully without slip, mark or distortion. Infinitely variable throughout its $\frac{1}{2}$ in. capacity, a single Multibore replaces many conventional collets. Multibore Collets can accommodate any diameter between $\frac{1}{2}$ in. and 2 in., or metric and decimal equivalents. Also Hexagon and Square within its capacity. It is partnered in efficiency by the remarkable Crawford Hydraulic Chuck.

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With its own self-contained hydraulic system free from any wear and tear or gears, toggles, balls or cams, it is the most powerful dead-length chuck in the world. Send for descriptive leaflet today.



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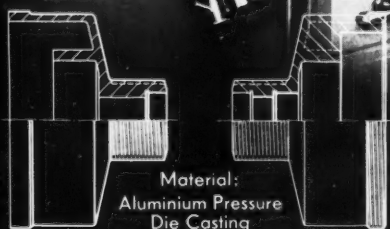
especially suitable for the machining of castings, forgings, pressings and billets.

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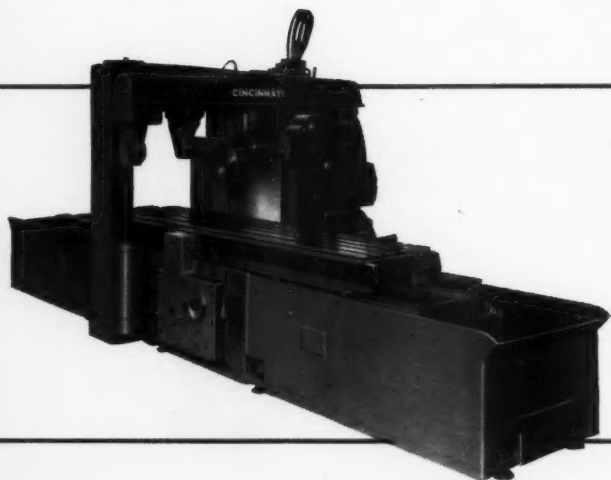
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CINCINNATI**TRACER CONTROLLED STYLES**

embody all the features of standard
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operations through a hydraulic
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STANDARD SIZES

to fulfil modern production requirements

HyPOWERMATICS Rugged, heavy duty, production milling machines — with 168 standard sizes from which to choose.

Table Widths— 18", 22" & 26" wide.

Table Travels— from 36 inches to 14 feet.

Spindle Carriers— three sizes from 10 h.p. to 50 h.p.

Table Feeds— infinitely variable from 1/4 to 150"/min.

CINCINNATI EXCLUSIVE FEATURES!

Automatic Variable Table Feeds— ensure constant use of maximum horsepower.

Hydramech Table Drive— embodies automatic backlash eliminator and provides maximum driving force directly beneath the cutter regardless of table travel.

Dynapoise Overarm— absorbs cutter vibrations leading to improved surface finish and longer cutter life.

PLUS Hardened and Ground Table Ways—

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Automatic Spindle Stop—

Massive Construction—

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with automatic lubrication for long and accurate life.

operating reduced to movement of a single lever.

prevents marring of finish surfaces on return stroke of table.

ensures stability under all cutting conditions.

offers "made-to-measure" machines at standard prices.

Full specifications are contained in Catalogues M-1871E (standard machine) and M-1909E (tracer controlled machine)

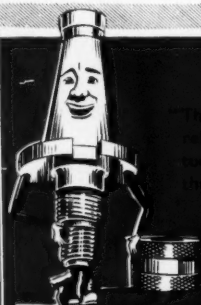
ENGINEERING MACHINES LIMITED
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Screw-locked milling...

MACHINERY

AT ITS SIMPLEST
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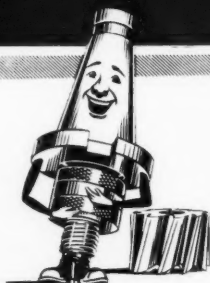
"They've done it again. You can rely on Dormer to turn out the tools for peak performance with the greatest accuracy and the least trouble. Look how easy this is."

DORMER HELI-MATIC ARBORS AND SCREWED BORE CUTTERS

This high-efficiency combination simplifies screw-locked milling and achieves the greatest productivity. Ease of assembly, precision in performance, and duration of working life, are the outstanding features of the Heli-Matic equipment.

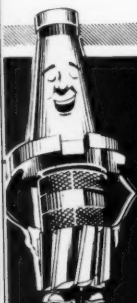
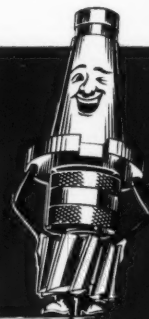
FIRST STAGE

Screw on the nut by hand—as far as it will go.



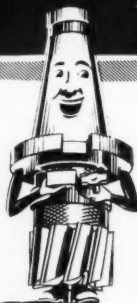
SECOND STAGE

Turn the nut counter to lock the nut—tighten with a spanner.



THIRD STAGE

Go back the nut driver to back the nut—tighten with a spanner. The cutter will lock solidly on the nut, making a rigid tool.



TO RELEASE

Apply the spanner to the nut and a few sharp hammer blows will release the nut from the cutter, which can then be screwed off by hand."

You can't go wrong—send for the Heli-Matic brochure giving the full range of Arbors and Cutters.

DORMER

Heli-matic

THE SHEFFIELD TWIST DRILL AND STEEL COMPANY LIMITED
SHEFFIELD ENGLAND

DORMER TOOLS ARE OBTAINABLE FROM YOUR USUAL ENGINEERS' MERCHANTS

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accurate

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LINDNER

Optical Jig Borers

Optical measuring system does not depend on lead screws, gauge blocks, bars or limit switches—is permanently protected against mechanical wear. Only a light beam touches helically scribed cylindrical measuring scales which are independent of table movement mechanism and are immovable in axial direction.

Photo-electric optical centring device minimizes visual fatigue and errors in settings—permits initial and repeat settings guarantee accurate within 0.00015in. and readings in 0.00005in.

AUTOPOSITIONER enables operator to preselect table position for next hole while one boring operation is in progress—eliminates non-productive time between holes. As one hole is completed, table moves in rapid traverse to the next pre-selected position. (Available only on Model LB15A.)

Projection screen eliminates operator eye strain and bending—helical line from measuring scale is projected on 2½in. by ¾in. screen which operator reads in standing position without eyepiece.

Automatic table clamping prevents errors in clamping and unclamping table between movements.



Model LB15A with AUTOPOSITIONER
Table size 44" x 24" (Illustrated)

Model LB14 32" x 16"
without AUTOPOSITIONER

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KINGS CROSS, LONDON, N.1**

Telephone : Terminus 3699 Telegrams : Stedall, London, N.1



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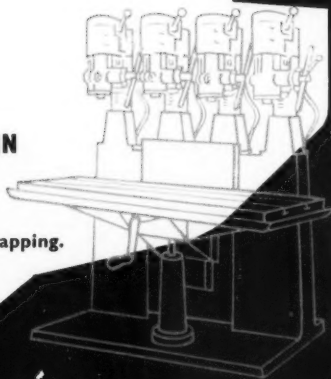
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EQUIPMENT**



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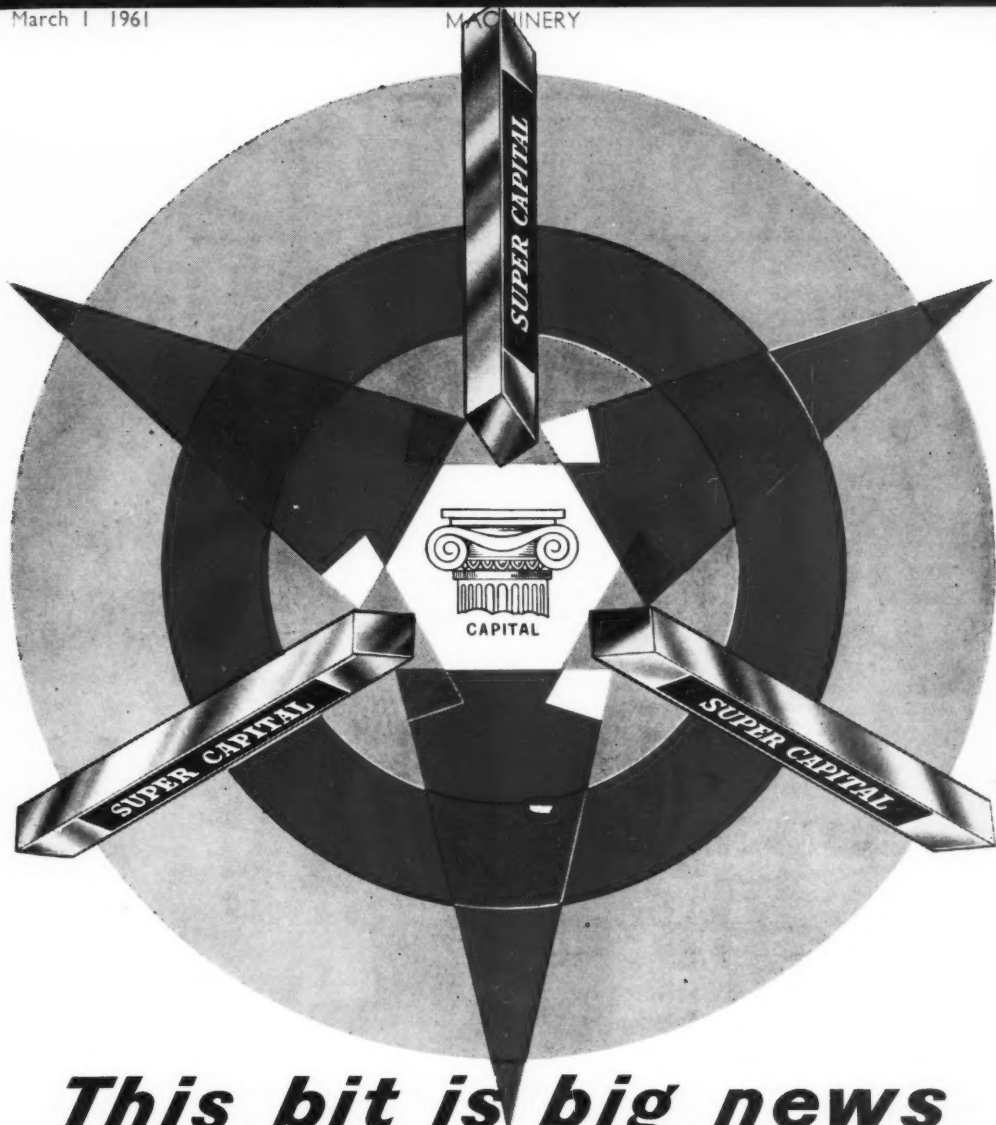
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- Assures accurate, dependable, sensitive tapping.
- Affords automatic tap protection.



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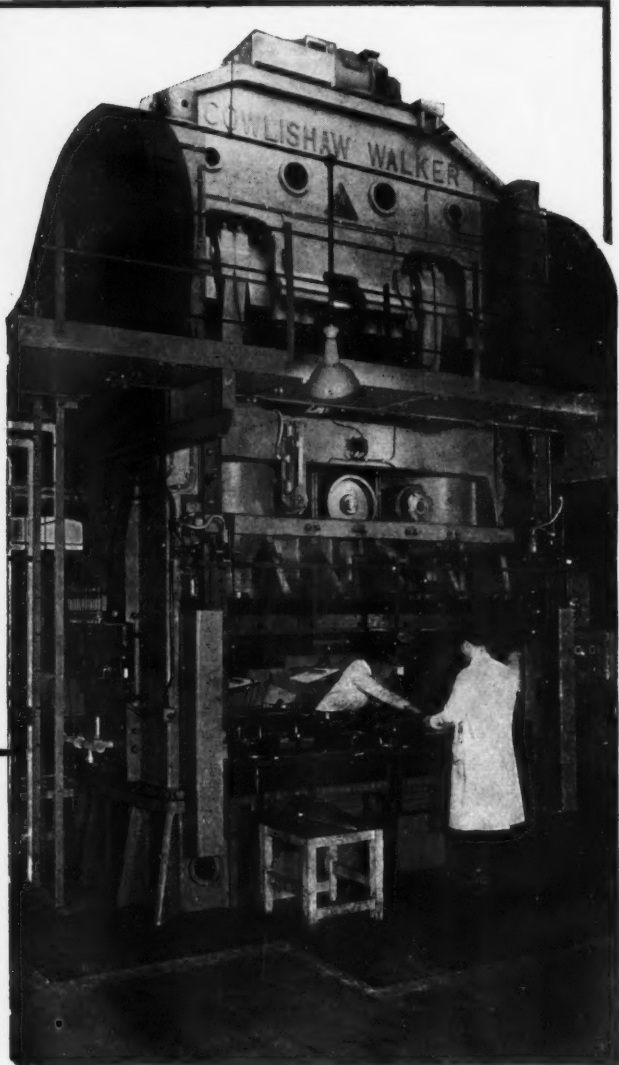
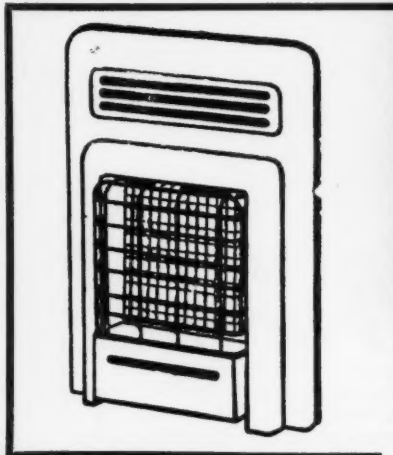
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400 TON PRESS

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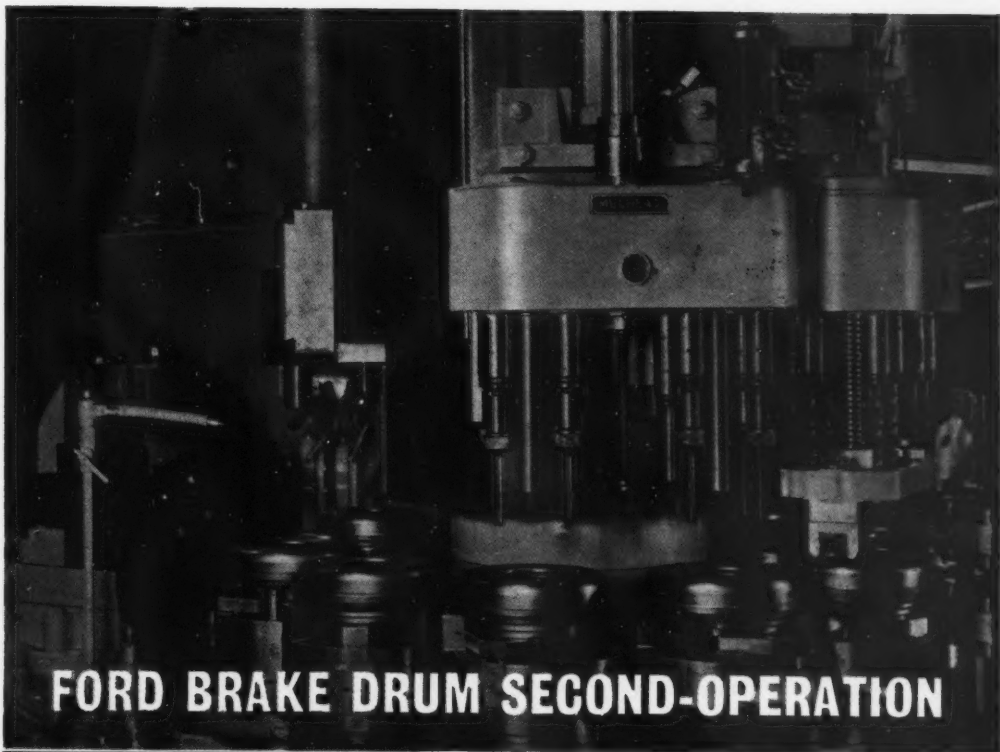
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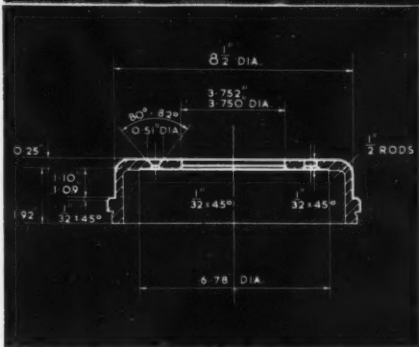
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MACHINED IN 40 SECONDS

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Makers also of single spindle Rydermatics and Piston
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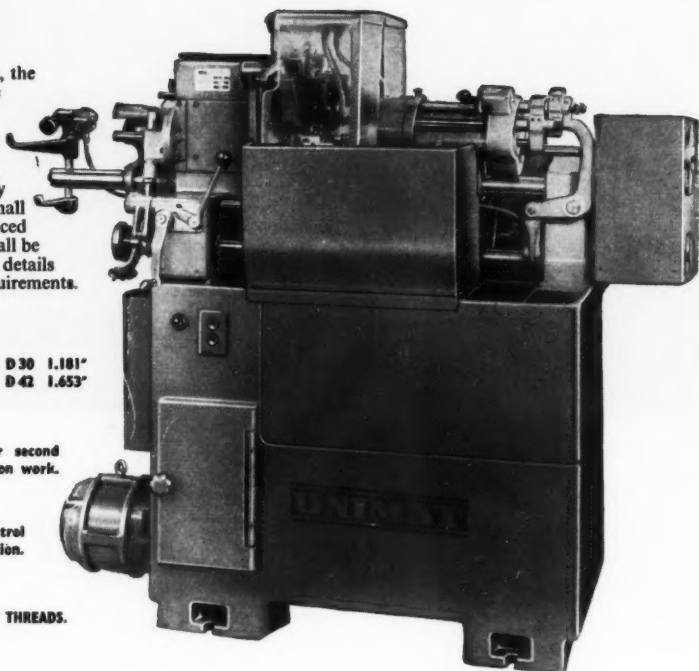
THE NEW

UNIMAT

AUTOMATIC LATHE

D30 / D42

Available in two sizes, the UNIMAT Automatic Lathe is ideal for all cutting and profile turning work. Setting-up and fitting times are exceptionally short enabling even small quantities to be produced economically. We shall be pleased to supply full details to your particular requirements.



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D 42 1.653"

* MAGAZINE LOADING for second operation work.

* CONSTANT SPEED auxiliary control shaft for collet operation.

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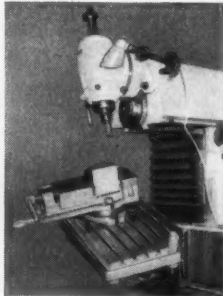
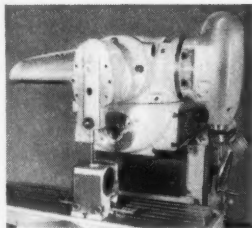
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THE MOST COMPLETE RANGE OF UNIVERSAL JIG MILLING AND DIESINKING MACHINES

These Four Universal Tool Milling and Diesinking Machines cover the requirements of all toolrooms large and small. Absolute versatility is provided by unique construction and extremely wide range of auxiliary equipment, including optical co-ordinate setting for jig boring. This range enables tools to be machined up to approximately one ton in weight.



OPTIONAL EXTRA ACCESSORIES INCLUDE . . .

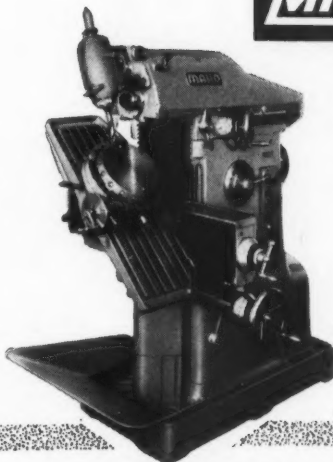
Vertical milling head, slotting attachment, high speed vertical milling head, rotary table, fixed swivelling and tilting, and swivelling tilting and inclinable tables, punch milling attachment, dividing head and spiral milling attachment, and on the larger models power fed vertical milling attachment will be available. It is also possible on the MAHO model MH.800 to fit this machine with hydraulic copying equipment, and on the model MH.1000 HEID electronic copying equipment is available.

Optical readers and rules can be supplied for the headstock slide, longitudinal traverse slide and vertical traverse slide.

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MORTIMER MACHINE TOOL CO. LTD.
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NRP 5083

MMT



CHECK YOUR TOOLROOM REQUIREMENTS AGAINST THESE MODELS

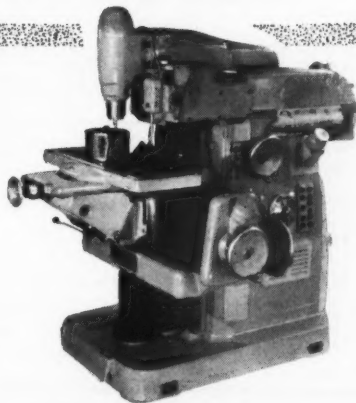
MAHO MH.600. Table 24" x 8½", horizontal spindle speed 55 - 1000 r.p.m., vertical spindle speed 99 - 1650 r.p.m.

MAHO MH.700. Table 27½" x 10½", horizontal spindle speed 65 - 1000 r.p.m., vertical spindle speed 99 - 1650 r.p.m.

MAHO MH.800. Table 31½" x 12½", horizontal spindle speed 32 - 1320 r.p.m., vertical spindle speed 45 - 1900 r.p.m.

MAHO MH.1000. Table 47½" x 14½", horizontal spindle speed 40 - 2000 r.p.m., vertical spindle speed 40 - 2000 r.p.m.

Models MH.800 and MH.1000 are equipped with independent spindle drive motors mounted on ram.



MORTIMER

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CAPSTAN LATHE TOOLHOLDERS

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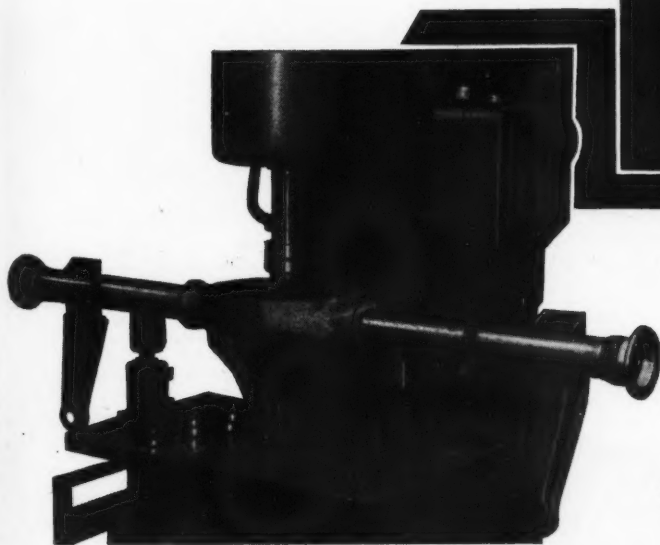
CHARLES TAYLOR (BIRMM) LTD. BIRMINGHAM. 5.

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Throughout all Industries . . .



. . . are being selected
for their adaptability to
a wide range of applications



A steel pressing, bush and rivets assembled and located by hand on to a four-station indexing fixture fitted to a Mills Press. Indexing is controlled by the ram, pre-set to apply the riveting load. This method has considerably reduced production time.

Open-gap type press with a top and bottom ram for fitting bearing cups into an axle housing.

In operation the upper bearing cup is inserted first, followed by the lower cup—table moves forward to facilitate loading.

For increased efficiency, reduced costs and higher output on all types of work involving straightening, bending, assembling, push broaching, squeeze riveting, coining, marking and similar operations we recommend the selection of Mills Presses.

The above illustrations are typical examples depicting the adaptability of Mills Presses to the demands for higher, economical production.

They are built in a range of sizes from 3 to 500 tons and, when required, special machines can be designed.

ALFRED

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LTD., COVENTRY Factored Division, Red Lane Works.



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AD.517

C2

THERE'S PLANT CAPACITY AT CARRON



It pays to use the production resources of Carron Company. 250 acres of plant for casting, forging, machining, enamelling and sheet metal fabrication are on call to manufacturers who find it uneconomic to tool up for the special job. The technical advisory service of Carron is ready at all times to help iron out production problems.

Consider this plant capacity for medium heavy machining: planing, vertical and horizontal boring mills; milling and drilling of work up to 5 tons; moulding and machining capacity for non-ferrous components up to 5 cwts., including high speed routing and precision milling. Fabrications, too, light and heavy gauge, stainless steel, press tools, welding. From small light gauge sheet metal to large plate welded fabrications, Carron can quote.

CARRON

CARRON COMPANY • CARRON • FALKIRK • STIRLINGSHIRE

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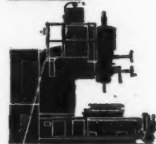
VERTICAL MILLING MACHINES



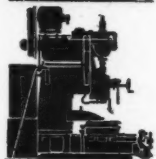
12 in. Carbide Ardoloy-tipped inserted-tooth face milling cutter in use on a No. 49V machine.



No. 47V has the power, speeds, feeds and rigidity for milling materials from aluminium to high-tensile steels. 32 speeds, 21 to 1525 r.p.m.; twenty-four feeds $\frac{1}{8}$ in. to 60 in. per min.; quick-power traverse to longitudinal motion. 48 in. by 16 in. by 23 in.



No. 49V. For heavy work requiring large table capacity. 32 speeds, 21 to 1525 r.p.m. Electronic feed drive, infinitely variable feeds from 0.8 in. to 40 in. per min. Quick-power traverse to longitudinal and traverse motions. 62 in. by 29 in. by 28½ in.



No. 28A. For heaviest class of work. 32 speeds, 12 to 540 r.p.m. Electronic feed drive, infinite variable feeds between 0.8 in. and 40 in. per min. Quick-power traverse to longitudinal and traverse motions. 62 in. by 29 in. by 30½ in.

All models now available for Early Delivery.

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AD.471

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Weekends

this keen amateur craftsman will use only the best tools—Spear & Jackson of course!



Weekdays

as a steel buyer in an engineering firm, it's not surprising that he makes a point of ordering Spear & Jackson tool steels.



Spear & Jackson make their own steel for their best quality saws — one of the reasons why they're the finest you can buy. The same care, the same striving after perfection, the same consistent

reliability, is evident in 'Spear' Tool Steel, too. In fact, it's made by the same men! Send for the 'Spear' Tool Steels data sheets — you can order from them with confidence.

SPEAR & JACKSON *TOOL STEELS TO TRUST*



Other products include: Segmental Saws • Hot Saws • Friction Saws
Hackaws • Metal Cutting Bandsaws • Fusion Bands • Tungsten
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The Hands of the Craftsman ...



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'HABIT'

DIAMOND POLISHING MILL

Built to satisfy the exacting demands of the 'HABIT' Diamond Polishing Staff, the HABIT MILL is now available to Industry.



The Habit mill embodies every essential feature for efficient diamond polishing that experienced craftsmen could envisage. Designed to provide an absolutely flat, vibration-free working surface enabling mechanical dops and either simple or complex fixtures to be employed. The internationally famous De Winter Scaife has been fitted, which does not require balancing and which is always parallel to the table to within 002" (0.05 mm).

There are no installation costs—simply plug in to the power supply and start work

★ *Look for the Little Flag!*

Further details on request:

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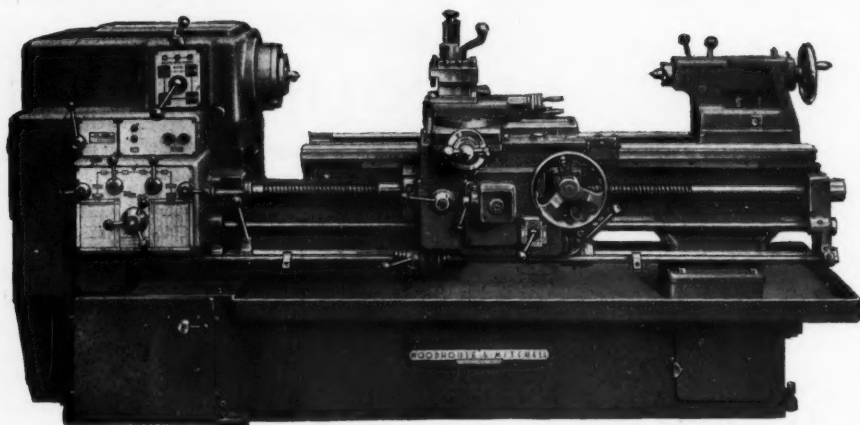
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THE **wm** RANGE

The range of machines produced by Woodhouse & Mitchell includes centre lathes, horizontal boring machines and turret millers. Three of the latest designs are illustrated here: built to modern specifications, they are being used with complete satisfaction by discriminating engineers.

wm wm wm wm



85' 8½" and 10½" Centre Lathes

8½ in. size: 10 h.p. motor, 12 speeds
21-945 r.p.m.

10½ in. size: 12 speeds
14-630 r.p.m.

alternative, 21-945 r.p.m.

WOODHOUSE & MITCHELL

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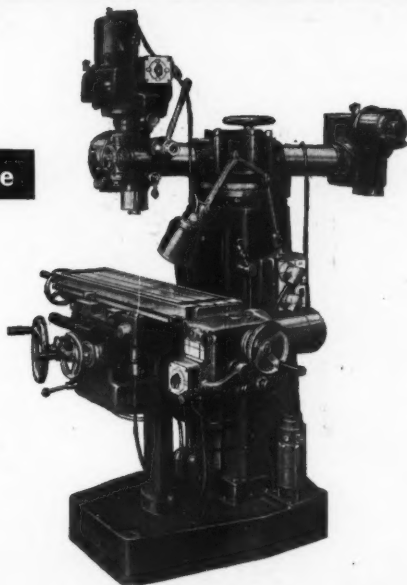
'70' Junior 7" Centre Lathe

2 h.p. motor; 8 speeds, 30-437 r.p.m. also alternative 44-640 r.p.m., and (when fitted 2-speed motor) 30-874 r.p.m. and alternatively 40-1200 r.p.m. Sizes are made to admit 45in., 54in. and 72in. between centres.

WM WM WM WM

369 Turret Milling Machine

For milling, boring and jig-boring at any angle, key-way and end milling, die-sinking, mould and pattern-making. Table 36in. by 9in., 10 spindle speeds 100-2000 r.p.m. (alternative 200-4000 r.p.m.)



WAKEFIELD ROAD • BRIGHOUSE • YORKS

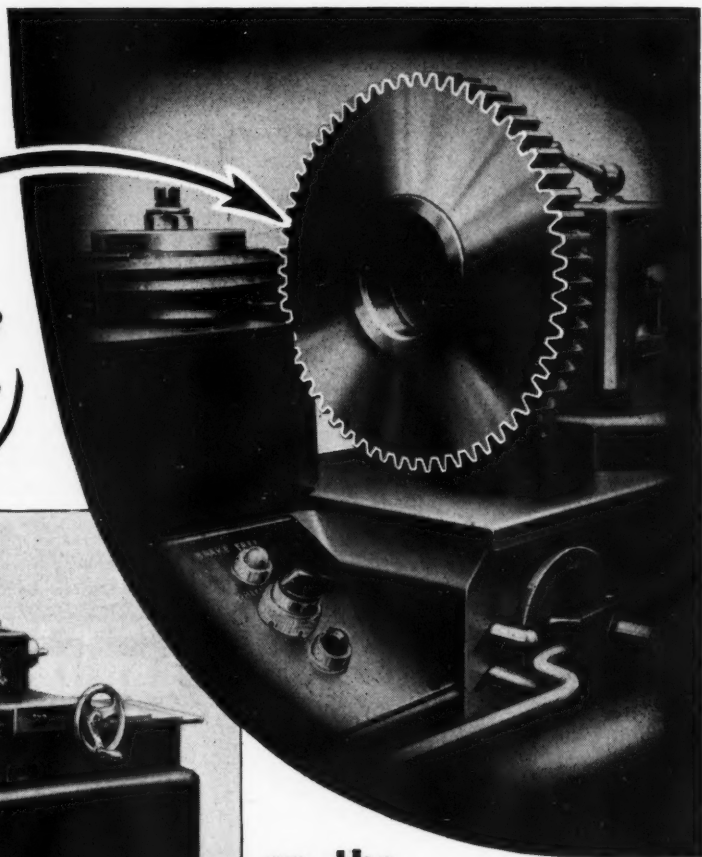
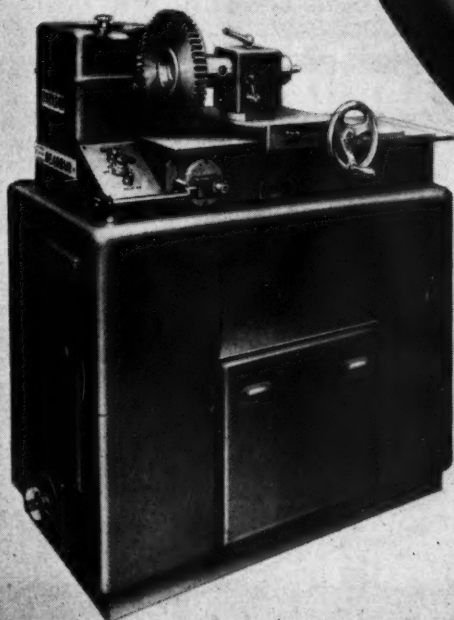
PHONE: BRIGHOUSE 627 (3 LINES) — GRAMS: 'WOODHOUSE BRIGHOUSE'

WM33

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**Deburr
GEARS
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*Grinding
Speed*



on the

PARKSON

GEARBUR

Deburs Spur & Helical Gears, even after hardening.

One wheel grinds any number of teeth of the same pitch and pressure angle.

Gears up to 11 in. dia. x 11 in. face. Teeth 25 d.p. to 5 d.p.

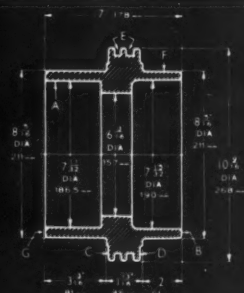
Floor to floor time: 10 seconds each side of gear.

Setting up time: 5 minutes per batch.

**J. PARKINSON & SON
(SHIPLEY) LTD**

SHIPLEY Telephone 53231 YORKSHIRE



Ward**SPECIAL****TOOLING LAYOUT No. 17****PISTON**

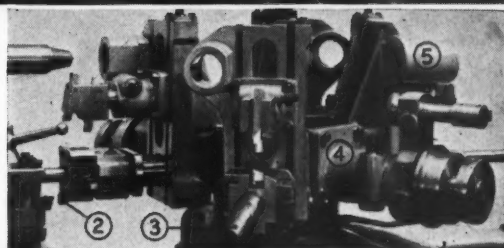
Machined all over.

**PERMALITE
MALLEABLE
IRON CASTING**Tungsten Carbide Cutting
Tools.**No. 8 TURRET LATHE**

Code Word : Covhylat

Equipped with 15" — 3-Jaw Tudor Chuck.

Total Floor to Floor Time : 22 mins.



DESCRIPTION OF OPERATION	Tool Position		Spindle Speed R.P.M.	Max. Cutting Speed		Feed	
	Hex. Turret	Cross- slide		Feet per min.	Metres per min.	Cuts per inch	m/m. per rev.
1st Process							
1. Grip internally in "A" (using loading attachment) =	1	—	—	—	—	—	—
2. Rough face "B" =	—	S.T.1	102	229	69.7	98	.259
3. Rough knee turn 10 1/2" & 8 1/2" dia. and rough bore 7 1/2" & 6 1/2" dia. =	2	—	84	238	72.5	136	.187
Face "D" =	—	S.T.2	84	238	72.5	270	.094
4. Form grooves "E" =	—	Rear	102	282	89	270	.094
5. Finish knee turn 10 1/2" & 8 1/2" dia. and finish bore 7 1/2" & 6 1/2" dia. =	3	—	132	365	110.2	136	.187
6. Finish face "B" =	—	S.T.2	172	375	114	136	.187
7. Remove component (using attachment) =	4	—	—	—	—	—	—
2nd Process							
1. Chuck on "F" (using attachment) =	4	—	—	—	—	—	—
2. Rough face "G" =	—	S.T.1	102	229	69.7	98	.259
3. Rough knee turn 8 1/2" dia. and rough bore 7 1/2" dia. =	5	—	102	229	69.7	136	.187
Face "C" =	—	S.T.2	102	282	89	270	.094
4. Finish knee turn 8 1/2" dia. and finish bore 7 1/2" dia. =	6	—	172	375	114	136	.187
Finish face "G" =	—	S.T.2	172	375	114	136	.187
5. Remove component (using attachment) =	4	—	—	—	—	—	—

'PRELECTOR'
Combination Turret
Lathes
with Preselective
speed-changing.

TURRET LATHES
with capacities up
to 35 in. swing over bed

1 1/2 in. to 2 1/2 in. 'D.S.'
DOUBLE-SLIDE
Capstan Lathes
for heavier
accurate work.

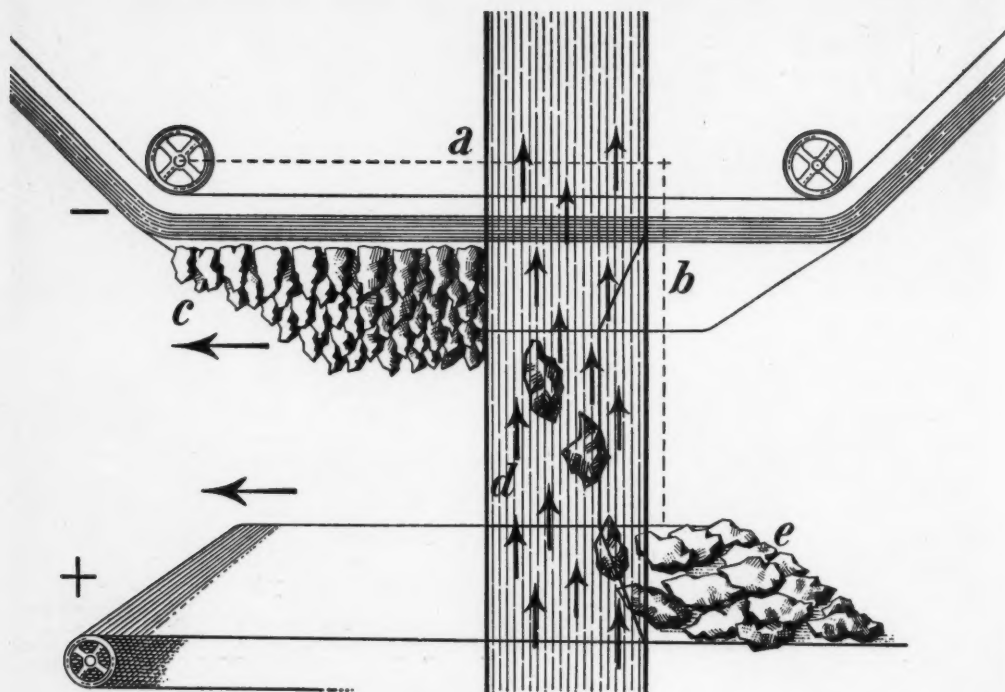
Stock Tools,
Toolholders, Chucks
and Accessories
for Capstan and
Turret Lathes.

**H. W. WARD
& CO LTD**

SELLY OAK, BIRMINGHAM 29

Phone: Selly Oak 1131





a cut above the rest?

YES a million cuts! And here's why

Every razor-edged grain in EAC abrasives stands bolt upright, presenting maximum cutting power to the work in hand. The grit, orientated on its longitudinal axis, is shot arrow-like into the adhesive by electrostatic force. That's why EAC abrasives literally bristle with cutting edges, work faster and last longer than ordinary makes. There's the right EAC abrasive for every operation. Insist on EAC for the best of good reasons—it saves money!



coated abrasives

ENGLISH ABRASIVES CORPORATION LIMITED

Marsh Lane, Tottenham, London, N.17. Telephone: Tottenham 5057

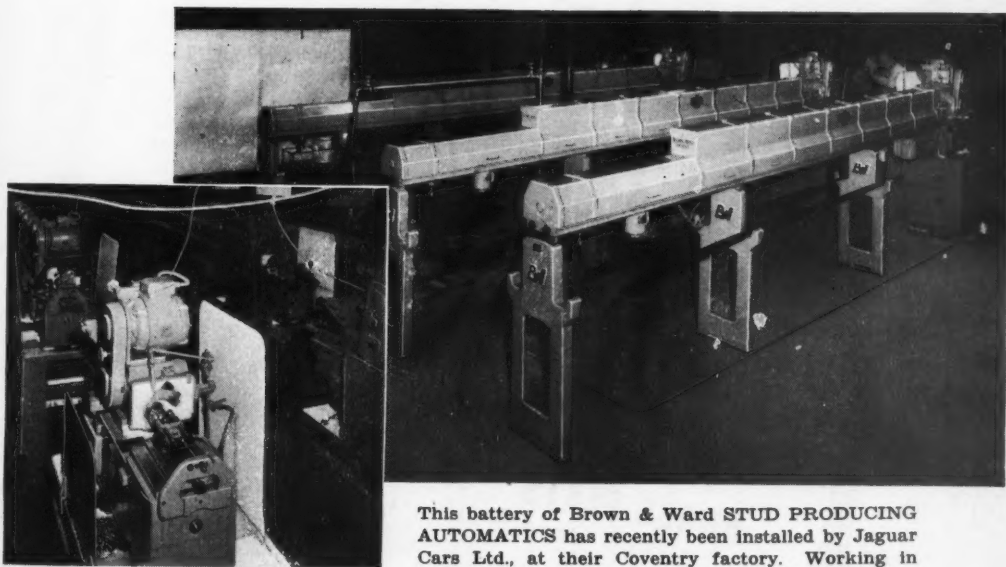
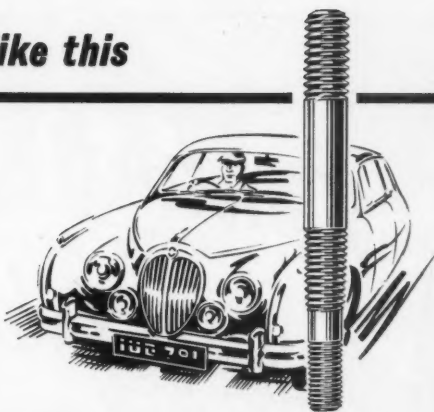
Subsidiaries: Thos. Goldsworthy & Sons Ltd. The Helvetia Abrasives Co. Ltd. London Abrasives Ltd.

B11/5

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JAGUAR cars
choose
BROWN & WARD



This battery of Brown & Ward STUD PRODUCING AUTOMATICS has recently been installed by Jaguar Cars Ltd., at their Coventry factory. Working in conjunction with Brown & Ward AUTOMATIC MAGAZINE BAR FEEDS these precision machines are producing components, like the threaded stud shown above, at maximum output and to the exacting standards required by Jaguars. The simplicity of these machines and equipment ensures reliability, and consequently a high productive efficiency, a fact which has been proved by the large numbers of machines installed in this and many other countries throughout the world.



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Automatic Bar Machines and Magazine Bar Feeders

BROWN & WARD (TOOLS) LTD.

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Telephone Bloxwich 76846

W & W

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Nettlefold & Moser

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ALUMINIUM SHEET
 Commercially pure aluminium (99%)—
 half hard temper.
 Sizes: 6 ft. x 3 ft.: 8 ft. x 4 ft.
 Thicknesses: from 24g to 1".

BRASS BARS
 High speed screw-cutting quality to BSS. 249.
 Sizes:—ROUNDS 3/32" dia. to 2" dia. SQUARES 1" to 1 1/2".
 HEXAGONS 5/16" to 1 1/2" A/F and .193" to 2.048 A/F.

BRASS FLATS
 To BSS. 218. Sizes range from 1" x 1" to 2" x 1".

DELIVERY AT WORKS RATES FROM STOCK

ring Nettlefold & Moser first

NETTLEFOLD & MOSER LTD., BOX 378, 170/194 BOROUGH HIGH STREET, LONDON S.E.1.

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The New Range

ZBROJOVKA

HEAVY DUTY PRODUCTION MILLING MACHINES

SERIES HORIZONTAL **FB** UNIVERSAL VERTICAL

Automatic working cycle in two directions, longitudinal and cross or longitudinal and vertical.

Control from pendant panel.

Automatic change of spindle speeds.

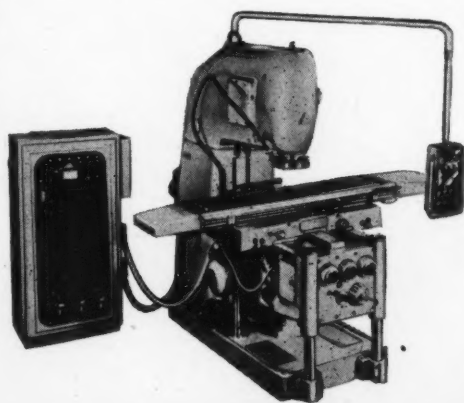
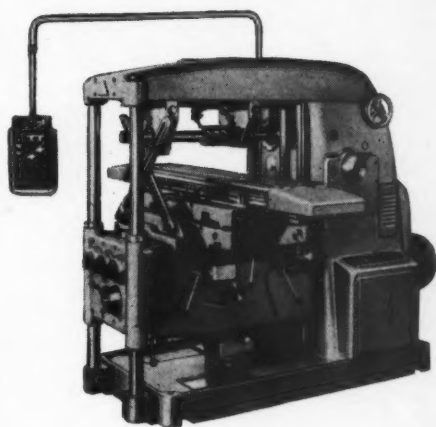
Separate motor drive to spindle and feeds.

Table feeds simultaneously in all directions.

Automatic retraction of knee from cutter at rapid return.

Built-in fly-wheel on spindle.

**PROGRAMME CONTROL BY
PUNCHED FILM TAPE
—IF REQUIRED**



MODEL		FB 32.	FB. 40.	FB 50.
Table size	ins	56 x 12½	71 x 16	89 x 20
Long traverse	ins.	38	47½	56
Cross traverse	ins.	12½	16	17
Vert. traverse	ins.	17½	17½	19
18 spindle speeds	r.p.m.		28 to 1400	
24 feeds long.	} ins./min.	½ to 80		
" cross				
" vert.	ins./min.	⅜ to 19½		
Rapid traverse long	} ins./min.	126		
" cross				
" " vert.	ins./min.	32		
Main motor	h.p.	14	26	36
Feed motor	h.p.	3	4	4

Selson
MACHINE TOOLS

The Selson Machine Tool Co. Ltd

SUNBEAM ROAD, LONDON, N.W.10.

Telephone Elgar 4000

STANNINGLEY, Near LEEDS

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And at Kingsbury (Nr. Tamworth) Manchester. Glasgow. Swansea. Newcastle-on-Tyne
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INNOCENTI

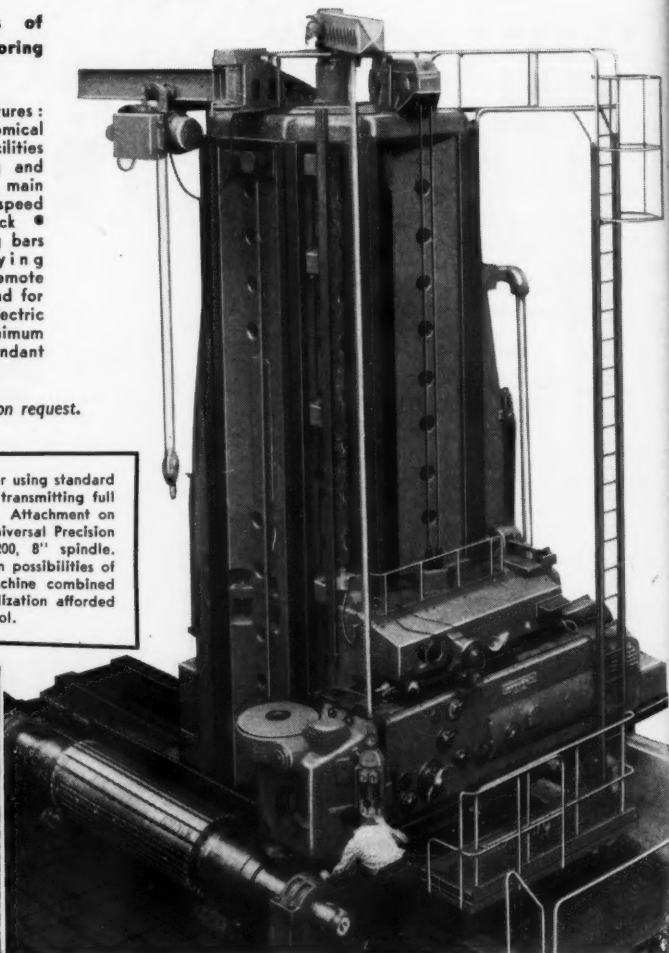
Maximum power, precision and production potential . . .

are essential characteristics of
**INNOCENTI-CWB Milling and Boring
Machines.**

Additional important features:
 • Maximum versatility • Economical
 production • Jig boring facilities
 • Large diameter surfacing and
 boring at right angles to main
 spindle • D.C. variable speed
 motors • Sliding headstock •
 Virtual elimination of boring bars
 • Facilities for copying
 • Facilities for automatic remote
 control electric measuring and for
 programme control • All-electric
 —no electronics • Minimum
 maintenance • Remote pendant
 control of entire machine.

Further information available on request.

Slotting of heavy turbo-alternator rotor using standard
 rotor slotting attachment capable of transmitting full
 machine power of 100 H.P. to cutter. Attachment on
 a standard Innocenti-CWB Heavy Universal Precision
 Milling and Boring machine FAF 200, 8" spindle.
 This arrangement offers the production possibilities of
 a special purpose rotor slotting machine combined
 with the high degree of machine utilization afforded
 by a heavy multi purpose machine tool.



Inserted by Henderson & Keay Ltd., Agents in Great Britain for
 INNOCENTI Mechanical Division, Milan.

HENDERSON & KEAY LTD., 189 PITT STREET, GLASGOW G.2.

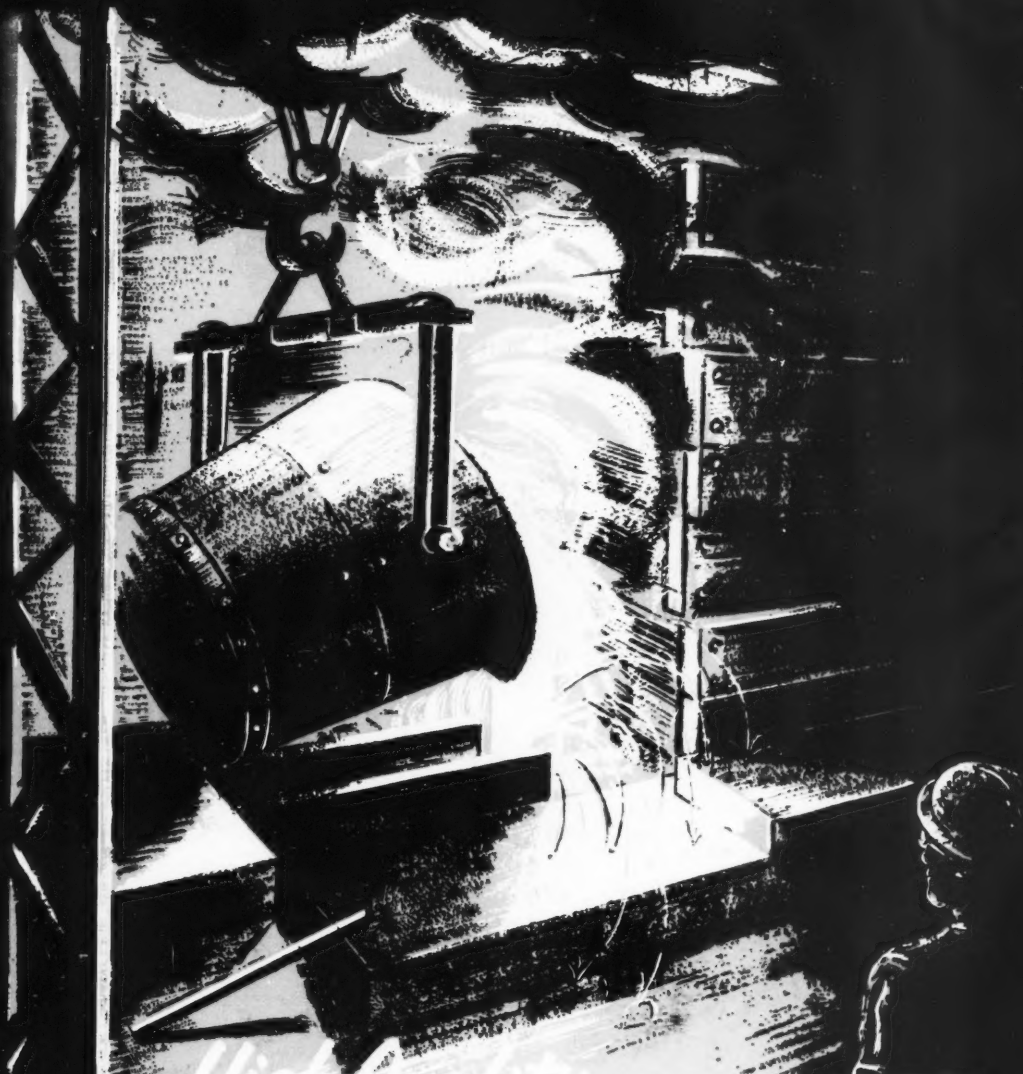
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High Quality **GREY IRON**
Castings

UP TO 30 TONS

by

GEORGE GARNER & SONS LTD.

VICTORIA STREET OPENSHAW MANCHESTER

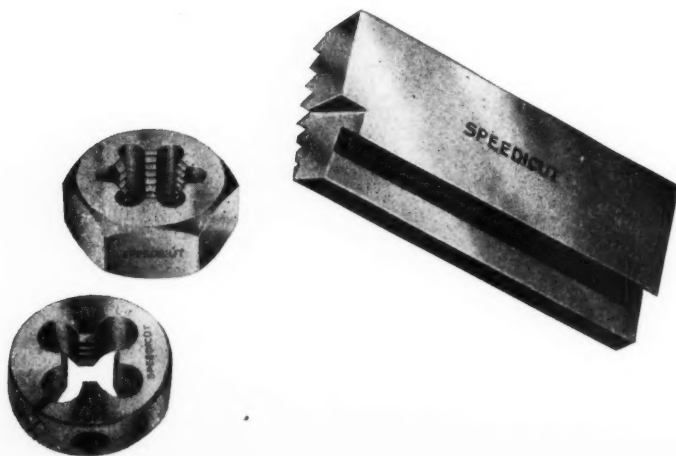
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WRITE FOR ILLUSTRATED BROCHURE

ASSOCIATE COMPANY OF W. E. SYKES

SPEEDICUT

TAPS & SCREWS



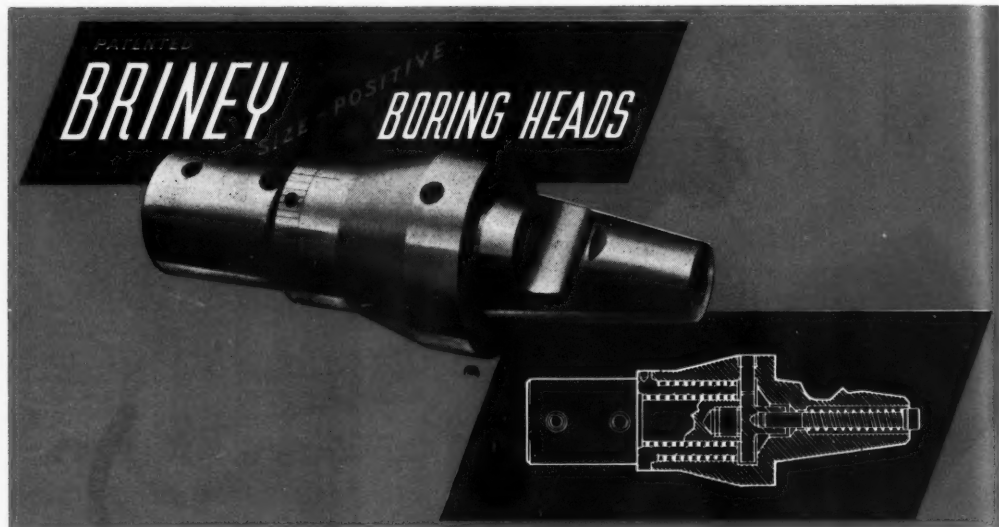
FIRTH BROWN TOOLS LIMITED



EVHREAD TOOLS

Speedicut Taps, working at a peripheral speed of 150 ft. per minute, give the remarkable cutting time of 1.2 seconds for a $\frac{1}{4}$ " B.S.F. nut. The tap life on 28/32 tons tensile steel nuts is 40,000/60,000.

Take advantage of latest techniques in toolmaking
SPECIFY SPEEDICUT.



The Briney Principle consists of a bushing mounted on pre-loaded ball bearings between the taper and boring bar. The hole in this bushing is slightly eccentric with its outside diameter.

The boring bar is driven by the taper and is locked by an integral pin and lock nut unit. Inertia and spring tension on the bar prevent adjusting slippage. Rapid tool adjustment without loosening or tightening any part is accomplished by rotating the bushing with a spanner wrench.

This rotating action moves the bar mounted in the eccentric hole in a slight arc. This action results in a vertical range of adjustment for the tool, but which is held in the bar by conventional screw locks.

Adjusting control is provided by graduating the outer surfaces of the bushing in increments of 1/10,000 inch or larger. Standard graduations are in increments of .00025. Usual range of adjustment from initial setting is .006 inch or .012 inch on diameter. Practice has determined this range to be ample.

FEATURED ADVANTAGES

• **PROVEN PERFORMANCE.** Briney Size-Positive Boring Heads have long been accepted by the Automotive Industry and are replacing other heads and quills of the adjusting and non-adjusting type.

• **SIZE CONTROL ACCURACY.** Accuracy in size control is provided by the adjusting principle which requires no loosening or tightening. Number of adjustments can be kept to a minimum because high limit can be obtained in any setting. Results in longer tool wear and more continuous production before low limit is reached.

• **TIGHT SEAL.** Whole boring head assembly is sealed against coolant and foreign particle infiltration. Construction permits coolants to be applied to work directly through bars from spindle.

• **RIGID CONSTRUCTION.** Extreme rigidity due to assembly being made on pre-loaded bearings and high quality tool steels used in manufacture. Bar is positively driven and keyed to flange to eliminate backlash.

• **PRECISION FINISHED.** All finished diameters are held to close tolerances and boring heads are finish ground all over for balance controlling purposes.

• **BALANCE** Heads tested up to 9,000 R.P.M. before any out of balance conditions have been detected. Out of balance conditions kept to minimum because the mass weight of the head is concentric with all diameters. Light weight of bar and slight eccentricity of bar only minimize out of balance conditions when operating.

• **LONG LIFE.** Any moving part in assembly is used only in adjusting. Parts do not wear out through usage. Bars are replaceable in case of damage. Replaceable bars are less costly than solid quills.

• **INCREASED PRODUCTION.** Scrap is reduced and production increased due to rapid accurate size controlling adjustment feature. Accuracy and bore surface finishes eliminate successive operations such as honing or grinding.

• **QUALITY CONTROL.** Ability to set tools to high limit on initial setting and maintain tolerance provides definite aid in maintaining statistical production quality control.



PRECISION GEAR MACHINES AND TOOLS LIMITED

An Associate Company of National Broach & Machine Co., Detroit U.S.A.
"World's Largest Producer of Gear Shaving Equipment"

RED RING WORKS, BODMIN ROAD, WYKEN, COVENTRY

Telephone: Wakegrave-on-Sowe 2372 Telegrams: Pregearmac, Coventry.

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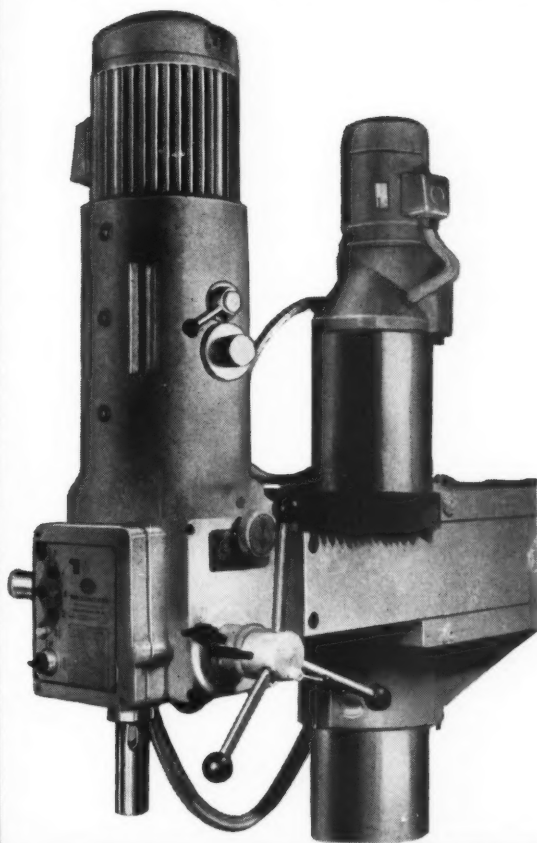
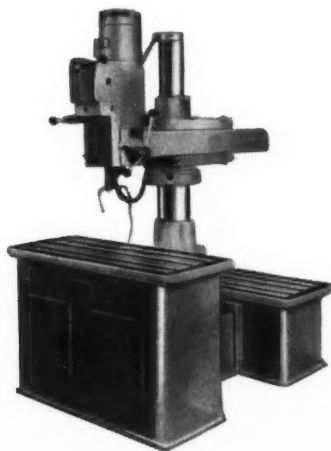
High Speed RADIAL DRILLING MACHINES

- ★ EASY OPERATION FOR UNSURPASSED PRODUCTIVE CAPACITY ON SHORT OR LONG RUNS.
- ★ FINGER-LIGHT MOVEMENT OF DRILLING HEAD.
- ★ CONTROLS CENTRALISED FOR MINIMUM OPERATOR FATIGUE.
- ★ GENEROUSLY PROPORTIONED WORKTABLE FOR MULTIPLE FIXTURES OR LARGE COMPONENTS.

MODEL DB 25 AVAILABLE IN FOUR BASIC TYPES

- (A) Drilling head **without** electro-mechanical feed **without** tapping mechanism
- (B) Drilling head **with** electro-mechanical feed **without** tapping mechanism
- (C) Drilling head **without** electro-mechanical feed **with** tapping mechanism
- (D) Drilling head **with** electro-mechanical feed **with** tapping mechanism

CAPACITY Drilling up to 30mm.—1 $\frac{1}{4}$ in.
Tapping up to M18 $\frac{1}{2}$ in. M24 $\frac{1}{2}$ in.



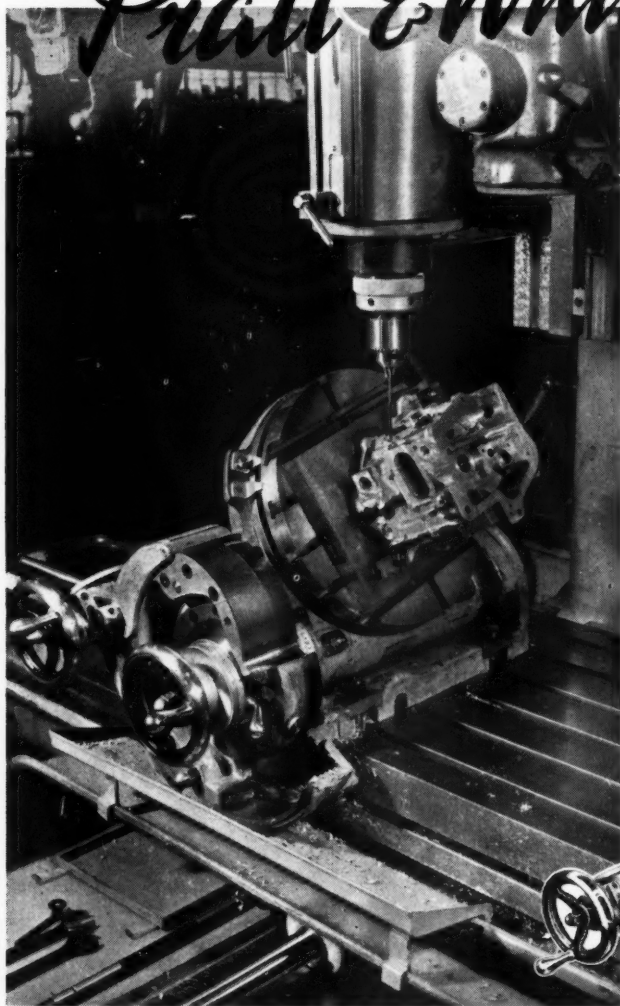
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WRIGHT ELECTRIC MOTORS
(HALIFAX) LTD.

MANUFACTURING ELECTRICAL AND MECHANICAL ENGINEERS
Established 1900

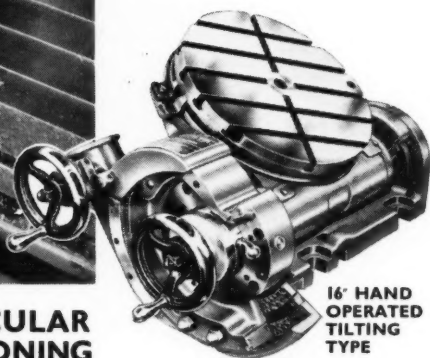
Branch Works: Elland Lane, Elland—Yorkshire Phone 2526

Pratt & Whitney



PRECISION ROTARY TABLES

PRATT & WHITNEY Tilting Rotary Tables are real time savers on all sorts of jobs requiring machining or inspecting at simple or compound angles. Where many faces in several planes must be positioned, these tables usually make it possible to perform several operations in a single set-up and eliminate the use of expensive jigs and fixtures.



FIRST CHOICE FOR PRECISE CIRCULAR SPACING AND ANGULAR POSITIONING

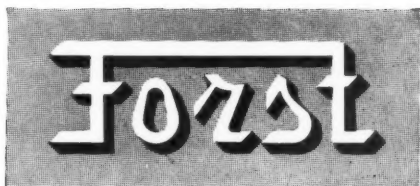
For full details write to Sole Agents in the United Kingdom for the Pratt & Whitney Co. of Hartford, Conn., U.S.A.

BUCK & HICKMAN LTD.

Machine Tools—Otterspool Way, Watford By-Pass, Herts.
Head Office—P.O. Box 74, Whitechapel Road, London, E.1.
Branches—Alperton, Birmingham, Bristol, Glasgow, Leeds, Manchester.

Pratt & Whitney Rotary Tables are available in a variety of types and sizes including 12in., 20in Hand operated—Plain Type—24in., 30in., 42in., 50in. Motor Driven—Plain Type—and 10in., 16in., 20in. and 24in. Hand and Power Tilting Types.

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*We are proud to announce that
the internationally famous*

Forst

B R O A C H E S

*are now being made in
England*

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We welcome your enquiries for broaches of all kinds, particularly for turbine blades and stainless steel and Nimonic parts.

Forst

BROACH COMPANY (G.B.) LTD.

DARTFORD ROAD., LEICESTER · TEL.: LEICESTER 31134.

TELEX NO. 34634 FORST GB LESTER

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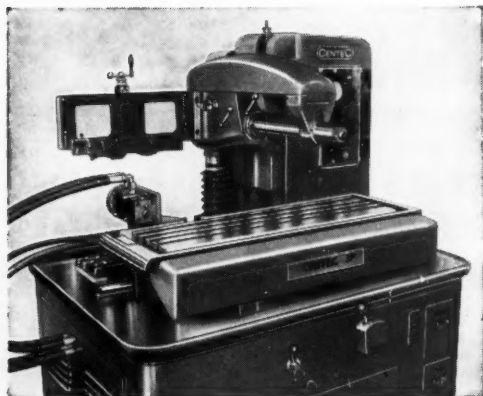
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fully PROGRAMME CONTROLLED

"CENTEC" 3R Automatic Milling Machines

Programme includes the cycle control of horizontal table and vertical head movements, as well as start and stop of main spindle.

Programme quickly set by positioning buttons in a programme plate. For short repeating production runs, the programme plate can be stored saving setting time when repeated. This machine will do a great number of consecutive machining operations automatically without resetting.



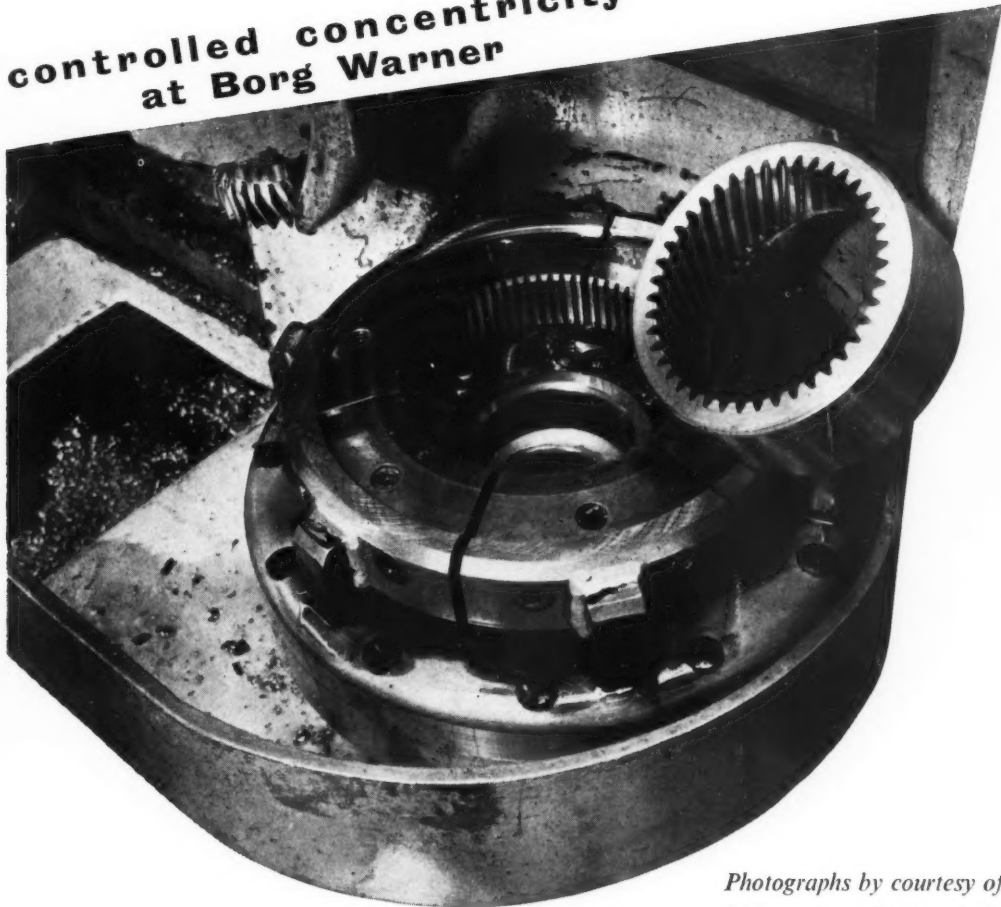
◀ PROFILE MILLING

with Very Great Accuracy
Angles up to 80 deg. to the Horizontal
Angles down to the slowest taper

with the 'CENTEC' 3P

CENTEC MACHINE TOOLS LIMITED • CENTEC WORKS
HEMEL HEMPSTEAD • HERTS • Boxmoor 584-5-6

controlled concentricity
at Borg Warner



*Photographs by courtesy of
Messrs. Borg-Warner Ltd.*

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CHUCKS
Famous for Workholding for 100 Years

diaphragm chucks

2 types available in 3 standard sizes

- Entirely proof against dust and swarf
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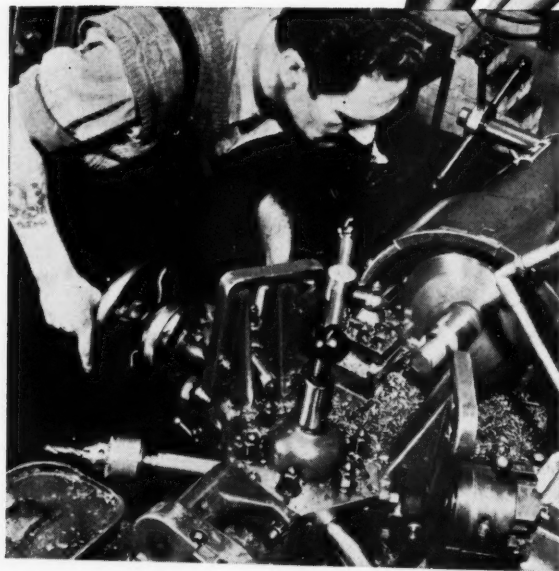
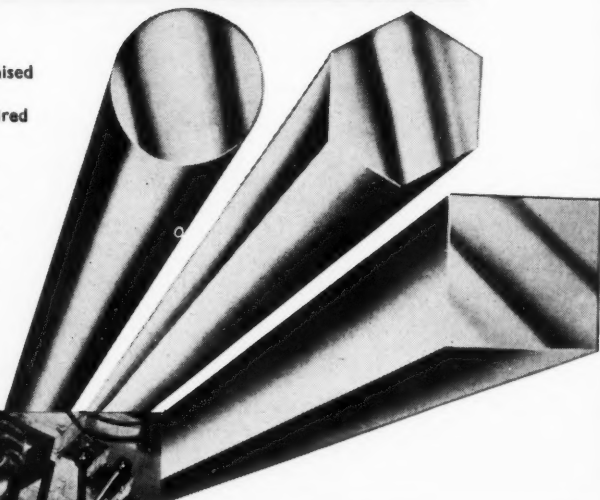
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Super freecutting bright mild steel

Produced specifically for CAPSTANS and AUTOS

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The engineering trade has long recognised the superior quality of this freecutting mild steel, which has acquired a wide reputation for ease of machining, high cutting speeds, long tool life and the ability to produce components of excellent finish and accuracy. Usaspead super freecutting bright mild steel is closely controlled for chemical composition and mechanical properties, and responds readily to normal case hardening treatment.



A COMPLETE RANGE OF
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IS AVAILABLE

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LIMITED

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Telex No. 22788

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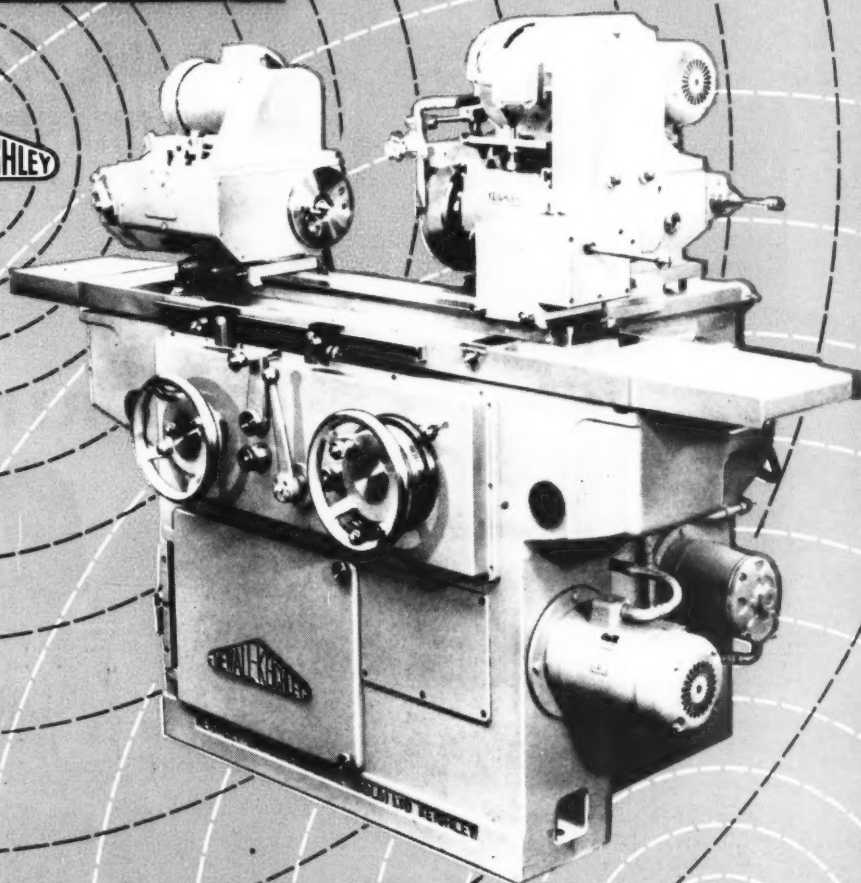
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fully UNIVERSAL
GRINDING MACHINE

5" centre height
20" max. grinding length

NEWALL-KEIGHLEY

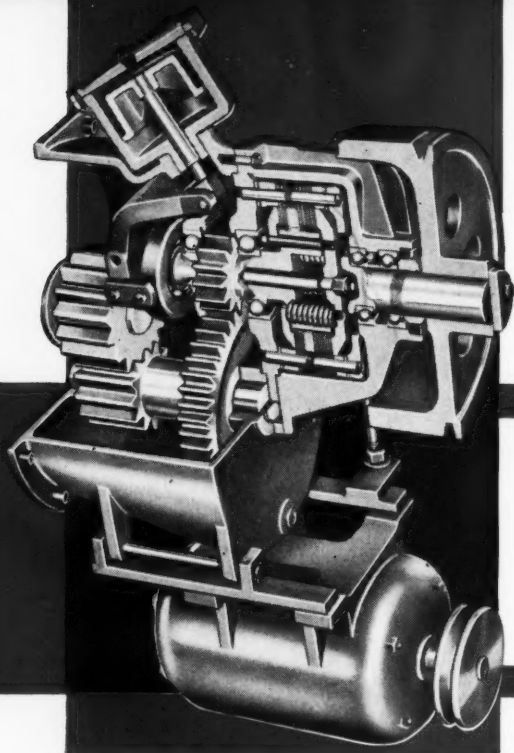


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NEWALL GROUP SALES LIMITED

PETERBOROUGH TELEPHONE 3227-8-9 or KEIGHLEY TELEPHONE 4294

P 9289



**Press
DOWN-TIME
CUT from days
to minutes...**

with this *Unique*
**INTERCHANGEABLE
DRIVE**

New **BRITISH CLEARING TORC-PAC AIR CLUTCH INCLINABLES**

These new look inclinables have been designed around the revolutionary TORC-PAC sealed-in-oil drive unit which never requires adjustment. Clutch and brake maintenance is eliminated by the permanently adjusted sintered bronze friction plates. TORC-PAC drives are completely interchangeable and replacement service units which are available from stock can be fitted in less than an hour.

DRIVE UNIT GUARANTEED FOR 18 MONTHS

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WITHIN PRESS FRAME

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BIG VARIETY OF SIZES

INCLINING ADJUSTMENT BY
SINGLE SCREW

MINIMUM FLOOR SPACE

22, 32 & 45 TON MODELS



ROCKWELL
MACHINE TOOL CO. LTD.

Built by **VICKERS**
WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

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March 1, 1961

MACHINERY

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ROLLS - ROYCE use HARPER CASTINGS

for the gear box and
steering mechanism
on the
Silver Cloud Saloon

You are invited to send for Harper's latest illustrated brochure of Castings in grey iron, spheroidal graphite and Meehanite (Regd. trade mark); metal pressings, machining, enamelling and sub-assembly work. On Lloyd's list for S.G. Iron Castings.



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POOLE FOUNDRY LTD. Phone: POOLE 212

Also makers of the famous Beatrice Oil Heaters and Harper Housewares

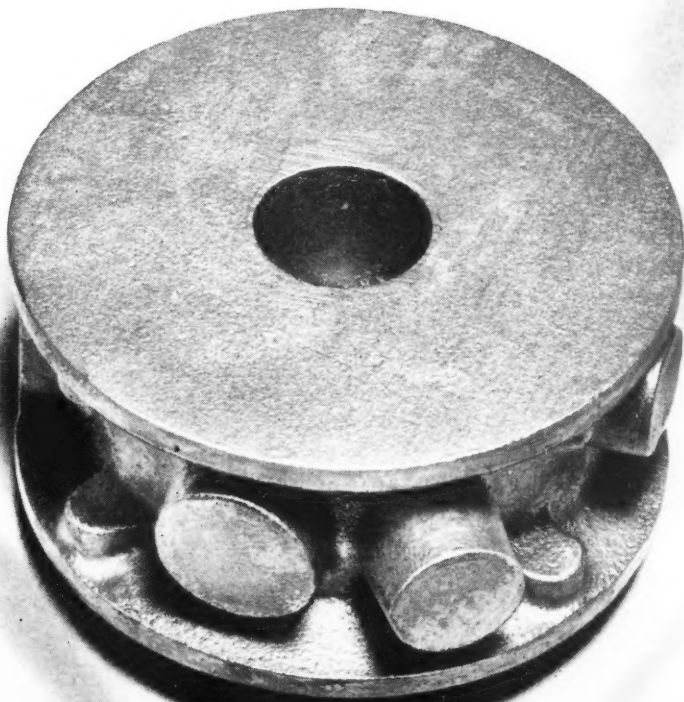
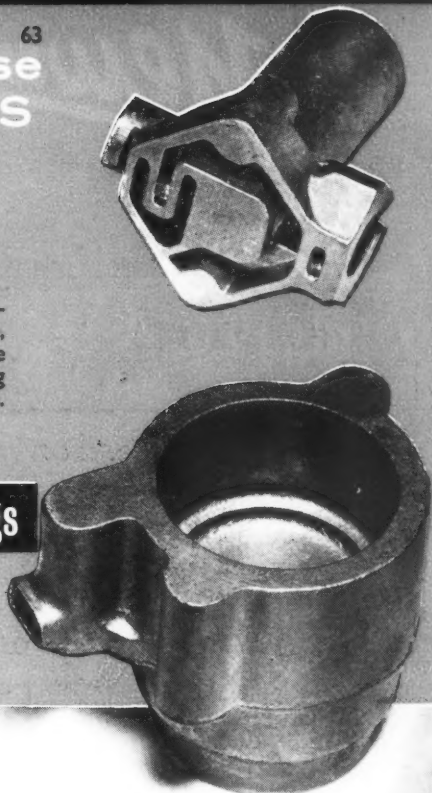
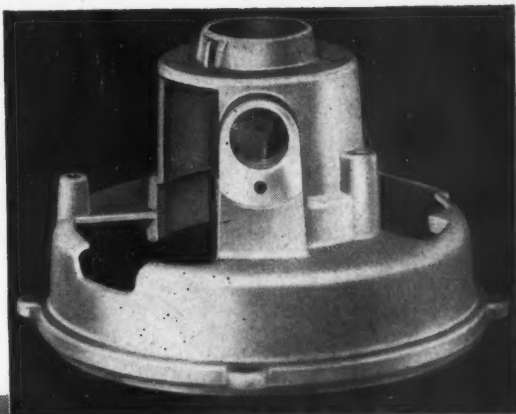


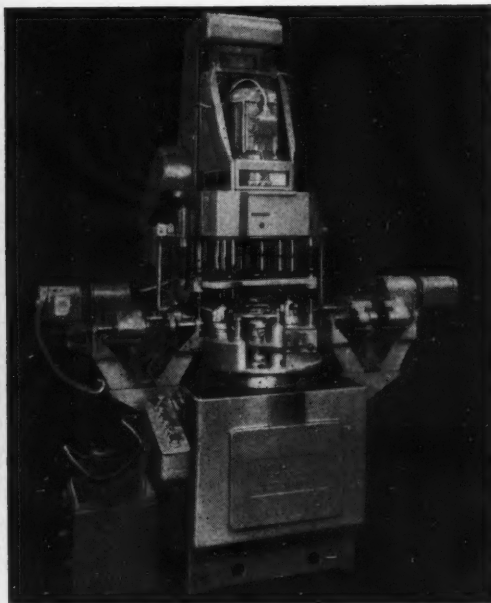
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Motor casings multi-drilled and tapped in four planes at the rate of 100 per hour; 14 holes drilled, 9 of them tapped...



Working with the MULHEAD Mk IV ROTARY AUTOMATIC



By successfully solving such production problems, this standard versatile high-speed machine raises output and reduces cost. It can probably do so for you.

Ask for a full specification.

Manufactured by
MULHEAD ENGINEERING Co. Ltd.

SOLE SELLING AGENTS:

Ryder

Thomas Ryder & Son Ltd.
Turner Bridge Works,
BOLTON, ENGLAND.

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CORONA

for super high speed

DRILLING



**Up to 18,000 r. p. m.
on continuous duty**

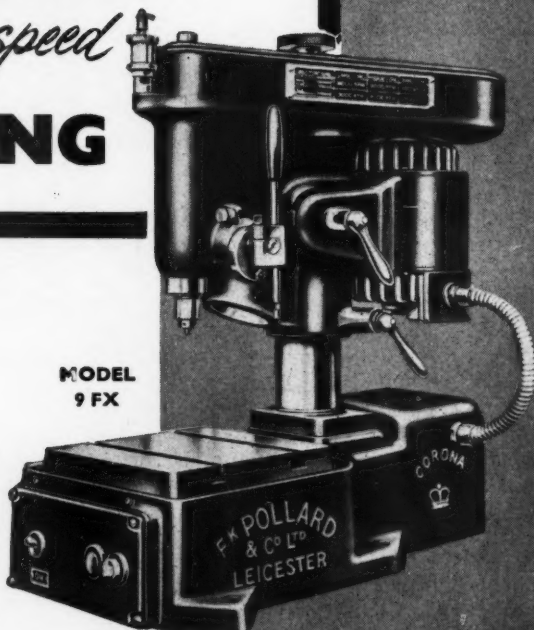
These super high speed sensitive drilling machines, built with from one to four spindles, have been specially designed for high speed operation. Drilling capacity is $5/32$ in. dia., in mild steel. Distance from column to spindle $4\frac{1}{2}$ in. Maximum distance between chuck and table is $4\frac{1}{2}$ in., with vertical adjustment of 3 in., and spindle traverse of $1\frac{1}{2}$ in.



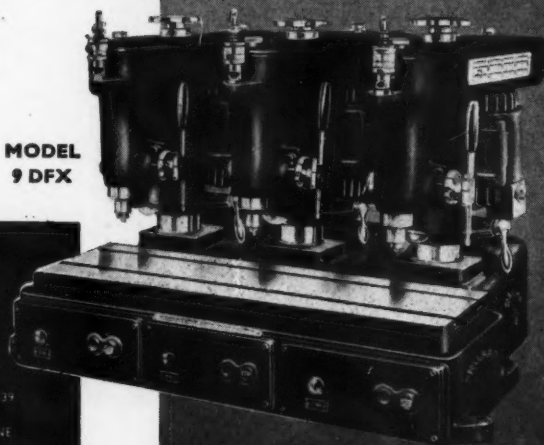
FREDK POLLARD & CO. LTD.

CORONA WORKS, LEICESTER, ENGLAND
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North East: HODSON MACHINE TOOLS LTD.
152 NEW BRIDGE STREET, NEWCASTLE UPON TYNE

**MODEL
9 FX**



**MODEL
9 DFX**



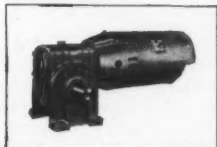
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THE INCREDIBLY VERSATILE VERSO

This new Holroyd 2½" centres motorised worm gear speed reducer has been designed to meet the need for a self-contained drive suitable for continuous use, and one which will look right in any surroundings. No matter what the application, it is possible to select from its variety of assemblies and mounting positions, an arrangement which makes it appear an integral part of the surrounding machinery, and *not* an added afterthought. The Verso has all the famous features of Holroyd reliability and high efficiency. Centrifugally cast Holfos wormwheel; casehardened and profile ground alloy steel worm; ball bearings throughout; rigid cast iron casing and oil bath lubrication requiring no attention over long periods. Output speeds are from 14 to 300 rpm. Output torques up to 750 lb. ins. Standard Motors from ¼ up to 2 hp. Please write for catalogue V.60 which gives further technical information.



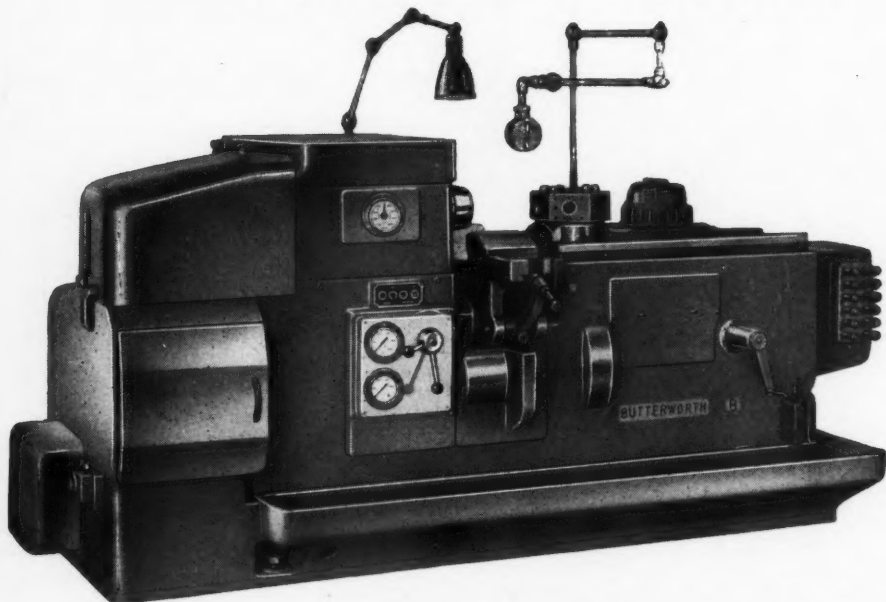
Holroyd

JOHN HOLROYD & CO LTD · MILNROW · ROCHDALE · LANCASHIRE
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★ ON SHORT OR LONG RUNS



BUTTERWORTH

HYDRAULIC AUTOMATIC

★ FOR BAR AND CHUCK WORK

The many outstanding features of this machine ensure faster cycle time and lower costs per piece . . . even on short runs. No special cams are needed and the exceptionally wide speed range covers all materials, from light alloys to high tensile steels. Hydraulic feed control. Hydraulic chucking. Hydraulic bar feed.

Three sizes, with capacity for rounds of 1½ in., 2 in. and 2½ in. respectively.

Hydraulic copy turning attachment and cross slide longitudinal turning attachment available.

Other sizes and models available include: 3 in. LIGHT DUTY, 3 in. and 3½ in. STANDARD DUTY.

Write for catalogue.

BUTTERWORTH
BRITISH AUTOMATIC MACHINE TOOL CO.
LTD.
LINCOLN ST., ROCHDALE

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For industrial equipment

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and get credit for it

Industrial machinery and light or heavy equipment can be bought on favourable credit terms through Bowmaker. Your local Bowmaker Branch Manager (under Bowmaker in the telephone book) will give you full details.

Motor vehicles, school fees, a boat, farming equipment, air-conditioning . . . Bowmaker credit plans solve a lot of immediate problems for a lot of people.

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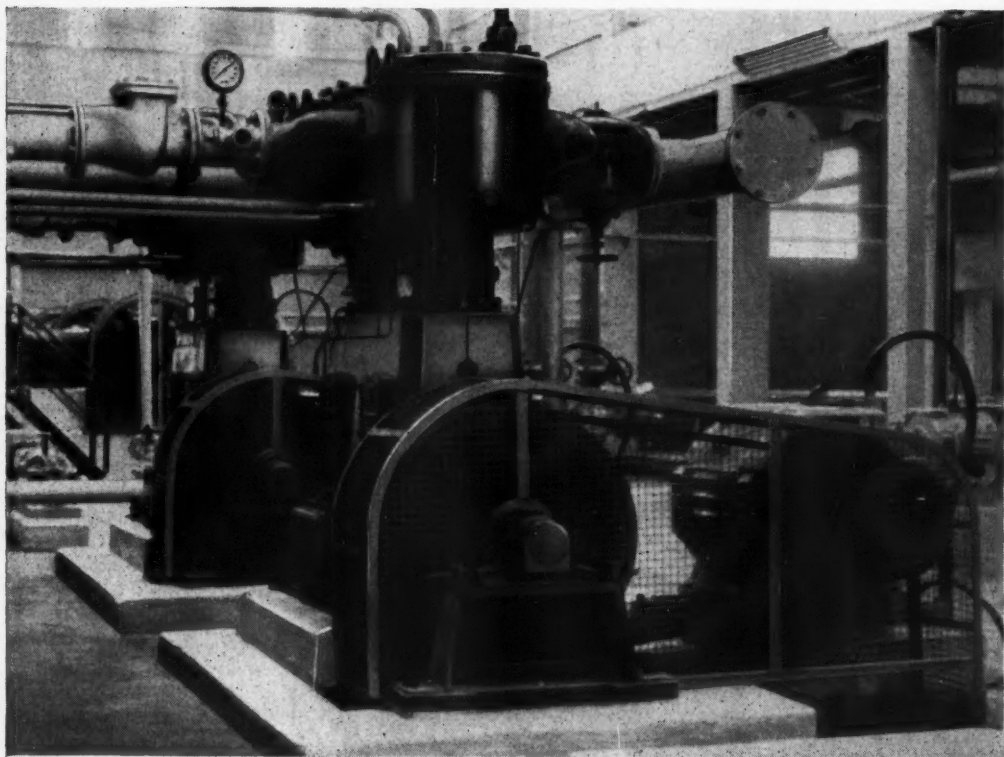
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"BROOMWADE" in Winkelhaak Gold Mine



Two "BROOMWADE" SS2 twin-cylinder single-stage double-acting compressors supplying air at 40 lbs./sq. inch at the reduction works of Winkelhaak Mine.
Photograph by Courtesy of Union Corporation Ltd.

At the Winkelhaak Gold Mine in South Africa "BROOMWADE" Type SS2 Air Compressors provide low pressure air for agitation of cyanide tanks used in one of the processes in the reduction works where the gold is separated from the crushed rock. Each compressor provides 1,225 c.f.m. of free air at 40 p.s.i., running at 420 r.p.m. As the machines are on continuous duty, *absolute reliability is vital.*

"BROOMWADE" have gained a world-wide reputation for RELIABILITY, EFFICIENCY and ECONOMY. Write to-day for full details of the wide range of Air Compressors and Pneumatic Tools covering the requirement of Mechanical and Civil Engineers.

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AIR COMPRESSORS AND PNEUMATIC TOOLS • YOUR BEST INVESTMENT

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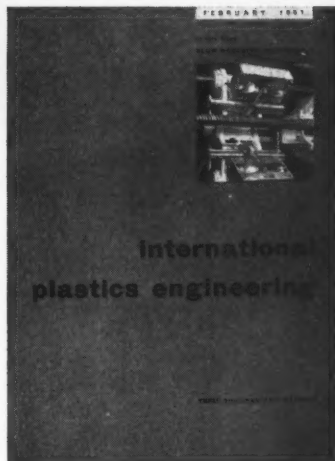
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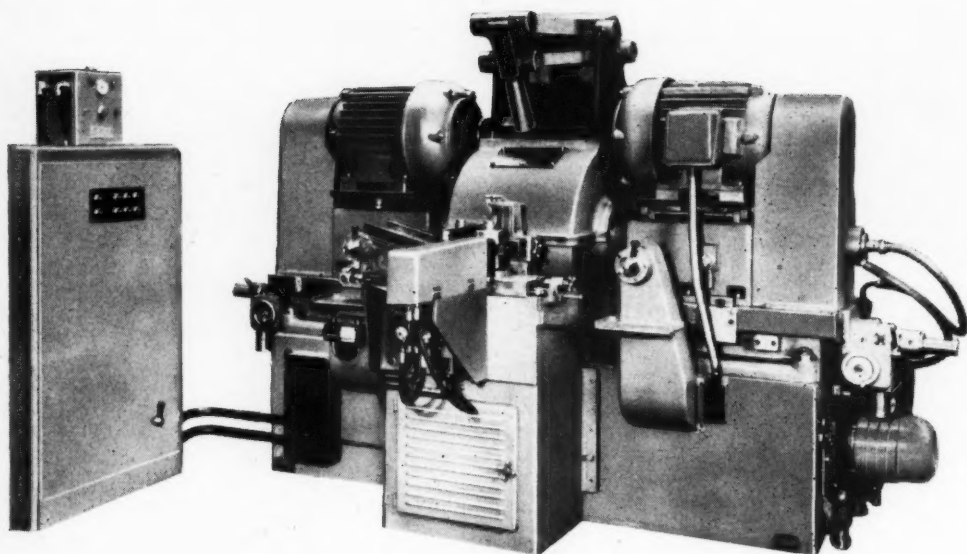
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TODAY**

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DOUBLE DISC Grinding Machines



*Capable of high stock removal whilst
maintaining fine finish and close limits*

These machines reduce costs by grinding two parallel surfaces at one operation. Workpieces are carried between the abrasive discs by methods which depend upon the size or geometry of the component and feeding arrangements range from manually operated systems to automatic loading devices with automatic sizing. Many of these machines are giving outstanding service in a wide range of industries producing components varying both in size and type of material.

World wide Distributors

DRUMMOND-ASQUITH LIMITED

Member of the Asquith Machine Tool Corporation

KING EDWARD HOUSE, NEW ST., BIRMINGHAM Phone: Midland 3431. Also at LONDON Phone: Trafalgar 7224 & GLASGOW Phone: Central 0922

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NASSOVIA

Automatic Copy Die Sinker

For the production of:

FORGING DIES

**HOT AND COLD COMPRESSION
MOULDS**

PUNCHES AND DIES

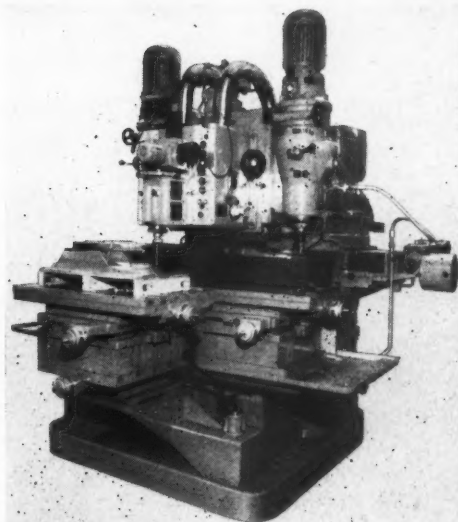
DRAWING TOOLS

PRESSURE CASTING DIES

INJECTION MOULDS FOR PLASTICS

The machine illustrated is a fully automatic type equipped with 2 milling heads for the simultaneous production of two components. The copying range is $31\frac{1}{2}$ in. x $15\frac{3}{4}$ in. x $4\frac{1}{2}$ in. deep.

Other die sinking machines in the Nassovia range are available with one milling spindle for automatic operation and for hand operation.



Sales and Service for the British Isles

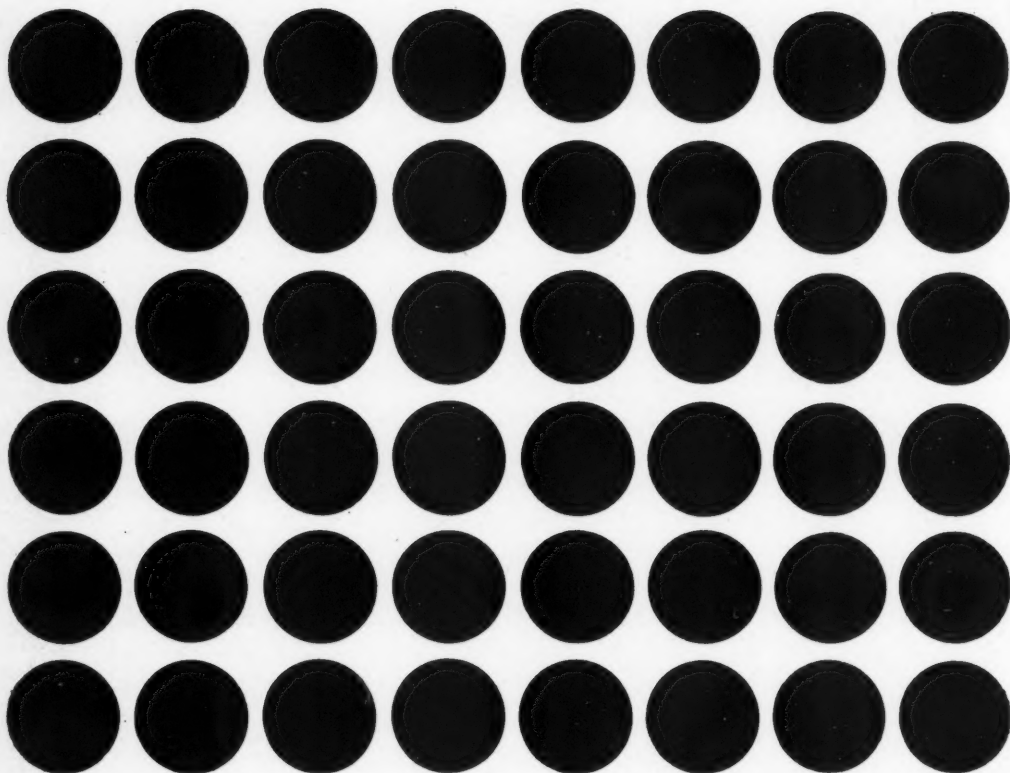
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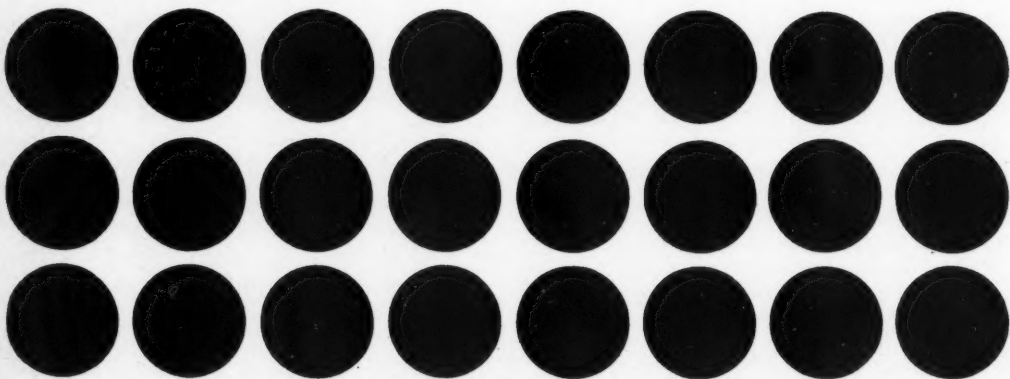
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Perfect repetition—as provided by Araldite epoxy resins for jigs, fixtures and press tools. Replicas cast in Araldite are quickly and economically produced; they do not shrink on setting, and are resistant to damp and chemical attack.



CIBA (A.R.L.) LIMITED · Duxford · Cambridge · Telephone: Sawston 2121

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TECHNICAL NEWSHEET

ITEM	Ronson Gas Lighter Body
OPERATION	Drill, counterbore, spotface, tap-all holes

The Rotary Transfer Machine illustrated is interesting because it utilises readily available standard items from our range. Ronson Products Ltd., the largest manufacturers of cigarette lighters in the U.K. designed the machine in collaboration with our engineers, to drill, counterbore, spotface and tap all the holes in a butane gas lighter. A 10 station, pneumatically-operated rotary indexing Table, specially designed for this duty, is fed with unmachined bodies held in separate holding fixtures which are carried to the loading station on a gravity feed roller conveyor. The positioning, final location and clamping of the fixture on the table is fully automatic. The complete machining cycle (detailed at right) is fully automatic and on the completion of each cycle a machined part is ejected in its carrier fixture down the conveyor for unloading. The operation of all spindles is positively interlocked with table movement and it is impossible for any spindle to advance unless the table is fully locked at the correct machining position.

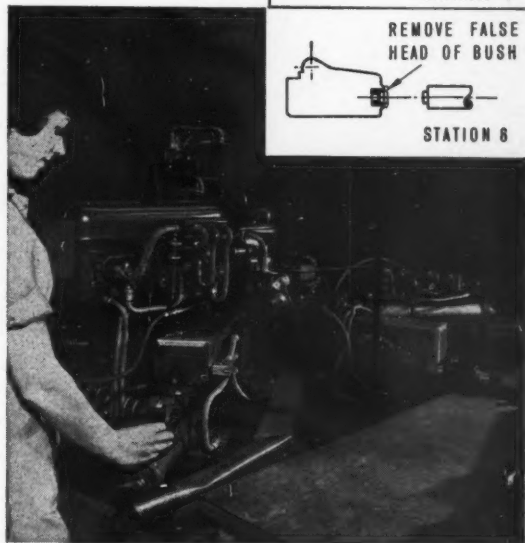
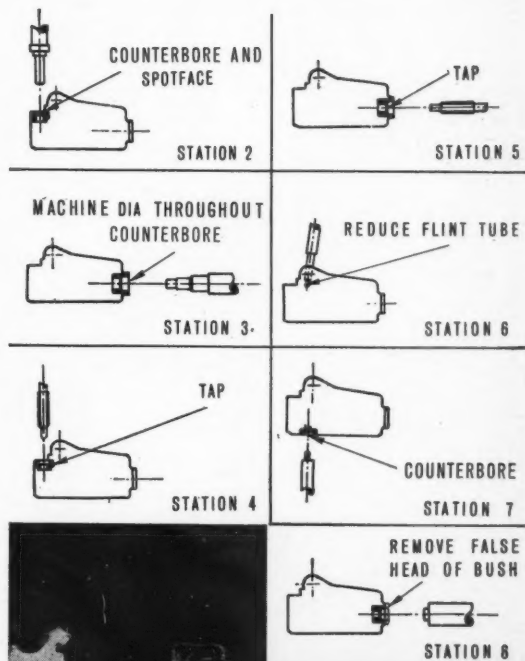
Appreciable savings in labour costs together with increased output have been achieved with the result that another British Company is able to compete more favourably in World markets.

We design and build special-purpose rotary or in-line transfer machines for drilling and tapping.

W. J. MEDDINGS LTD

SPECIAL PURPOSE DIVISION
IPSWICH ROAD • TRADING ESTATE
SLOUGH • BUCKS

Telephone: Slough 26761 (5 lines)



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...and you can make your own die sets - *but*
it's better to buy from **Desoutter**

DESOUTTER BROTHERS LIMITED, 121 HAY LANE, KINGSBURY, LONDON NW9

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eleven o'clock...

... and

FONDU CONCRETE

placed yesterday
is ready
for anything

Eleven o'clock—time for the traditional break and reminder that the FONDU concrete laid yesterday morning has reached full strength.

Unapproachable speed of maturing is only one of the advantages of FONDU concrete. It also has the unique merit that the concrete is permanent under many conditions which destroy ordinary concrete. Many industrial chemicals do not harm Fondu concrete, so that it is the safe solution to much constructional and repair work in many industries.

Also, using firebrick aggregate, CIMENT FONDU provides an adaptable refractory concrete for temperatures up to 1350°C. CIMENT FONDU can save you time and money on your concrete work by eliminating waiting time and keeping the concrete section always one step ahead of the others. Let us send you our 32-page booklet "THE CEMENT FOR INDUSTRY".



The Cement for Industry

FOR SPEED · STRENGTH · RESISTANCE · REFRACTORINESS

LAFARGE ALUMINOUS CEMENT CO. LTD. 73 Brook Street, London, W.1. Tel: MAYfair 8546
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twenty-one
taps
seven
sizes

in the
NEW
PRESTO
tap index

Hinged container with one set each of sizes $\frac{1}{8}$ in., $\frac{3}{16}$ in., $\frac{1}{4}$ in., $\frac{5}{16}$ in., $\frac{3}{8}$ in., $\frac{7}{16}$ in., and $\frac{1}{2}$ in. Whitworth Thread Taps.

Measures 5 in. \times 5 in. \times 1 $\frac{1}{2}$ in. when closed.

All-steel for strength, Presto for quality.

PRESTO

TAP INDEX

PRESTO TOOLS are made by EASTERBROOK, ALLCARD & CO. LTD.
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Telephone HOP 4511 (4 lines)

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DE LAVAL**CENTRIFUGAL
COOLANT CLARIFIERS**

ensure
HIGH-CONSTANT
Clarifying
Efficiency
unattainable by
any other method

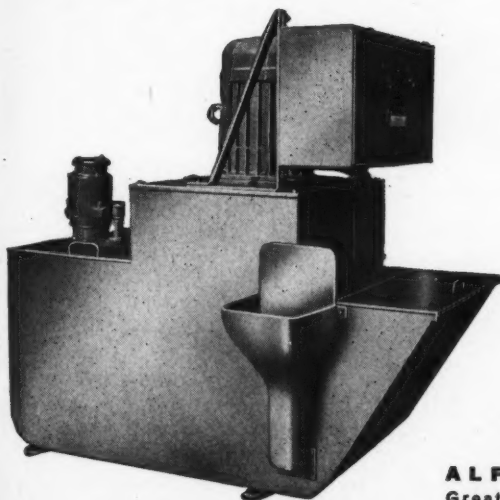
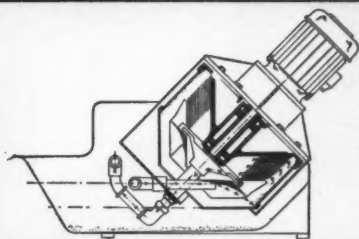
- * Closer grinding limits and better surface finish.
- * Prolongs tool and wheel life—less dressing required.
- * Extends coolant life and maintains maximum hygiene for operator.
- * Reduces labour and material costs.

For full particulars please consult our technical engineers . . .
 contact our **FACTORY EQUIPMENT DIVISION**.

**DE LAVAL****TURBO Matic
CENTRIFUGE**

Type BX 215-34S

Rated capacity 3480 g.p.h.
 (depending on application)

**DE LAVAL****TURBO Matic MINOR
CENTRIFUGE**

Type WX 209-34

Rated capacity 750 g.p.h. (depending on application).
 Fully automatic in operation including
 discharge of solids
 without interrupting flow of coolant.

ALFA-LAVAL COMPANY LIMITED
 Great West Road · Brentford · Middx. · Isleworth TW21

Screen's DL 437

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HANDS FOR INDUSTRY...

LET the various powered movements of the machine be represented by A, B, C, etc. Let the sequence of operations in the cycle be represented as A+B+A-C+A+B-D+C-A-D-E+E-. And let . . . and let and let's call in the Martonair Technical Service, which seems to make a habit of doing this sort of thing.

THAT'S MARTONAIR—The first name in applied pneumatics.



MARTONAIR LIMITED, Parkshot, Richmond, Surrey.
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CATTERMOLE

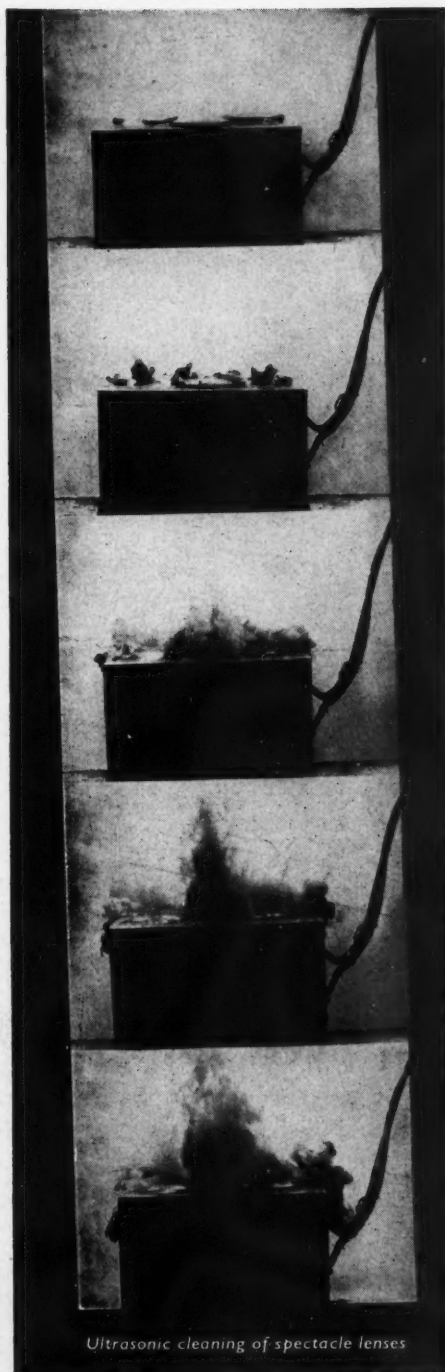
Cattermole Hydraulics

PROVIDE

POWER

H. S. CATTERMOLÉ & CO. (HYDRAULICS) LTD.

HYDRAULIC, GENERAL ENGINEERS & CONSULTANTS
PECKENHAM ROAD, ASTWOOD BANK, Nr. REDDITCH, WORCS.
Telephone: Astwood Bank 142/3



Ultrasonic cleaning of spectacle lenses

Ultrasonic Cleaning

cleans ultra-efficiently

HOW?

By introducing high frequency pressure waves in liquid cleaning media (alkaline or solvents), causing momentary tiny vacua, called cavitations. The effect is a mechanical scrubbing action on surfaces to be cleaned, removing all oily or solid contaminations like dirt, swarf or grease. The pressure waves are created by immersed nickel transducers, which oscillate at a frequency of 22 kilocycles, the source of which is a valve generator converting the mains current to high frequency current.

WHAT?

Ultrasonic cleaning is the most effective method of cleaning articles which are difficult to clean by ordinary methods. In particular, parts which are contaminated with solid soil, such as pieces of polishing cloth or polishing paste, swarf in fine holes, enclosed angles, ridges, ledges, hollows; parts with dirt deposits of long standing; parts having residues of hardening compound, etc.

WHERE?

Ultrasonic cleaning can be applied in any kind of conventional cleaning installation, such as alkaline cleaning tanks, Tri-degreasers, etc., by simply immersing the nickel transducers in the cleaning liquid. Special equipment entirely adapted to particular applications of Ultrasonic cleaning, either hand operated or fully automatic, can be supplied.

FURTHER QUESTIONS . . . concerning Ultrasonic Cleaning, its capabilities and characteristics, are answered in our special leaflet. Please write for a copy.

From Roto-Finish come these other surface treatments:

Barrelling and Vibrafiniting	Electropolishing.
for metal and plastics to	Ultrasonic cleaning.
debur, descale, deflash,	Mechanical cleaning.
radius, surface blend,	Grisiron Alkaline cleaners.
polish or lustre.	Euron cleaner passivator.
Atram phosphating	Conversion and protective
processes.	coatings.

Tell you more about any or all of them? We would be happy to if you write or telephone us.

Rely on

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to provide the finishing touch

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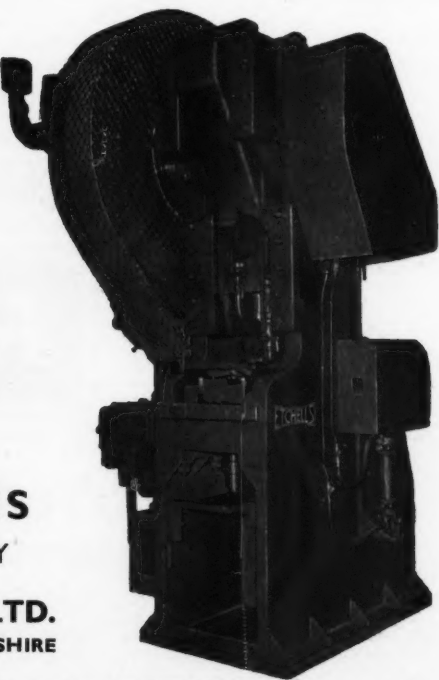
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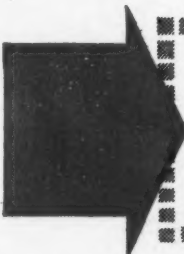


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The illustration shows one of the battery of Webster and Bennett Boring Mills installed in the London Works of Dewrance & Co. Ltd., facing, turning, boring and screwing 5" valve bodies in a floor to floor time of 66 minutes.



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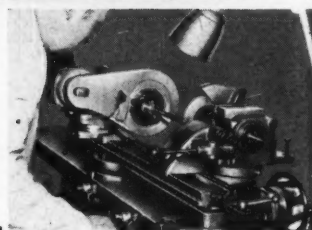
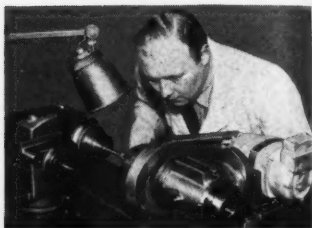
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OPERATING
POSITIONS****310**

Featuring:—

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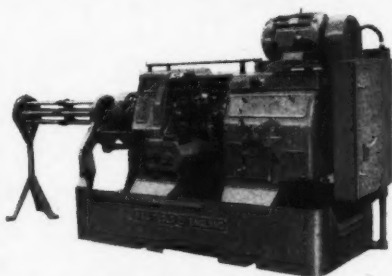
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London Office: 50/52 Great Peter Streets, London, S.W.1. Telephone: ABBey 5908/9.

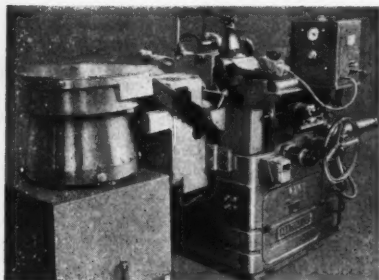
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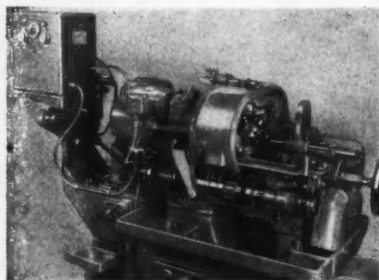
production machines



B.S.A. ACME-GRIDLEY $\frac{1}{2}$ " six-spindle automatic bar machine. Designed for high spindle speeds and fast cycle times combined with accuracy and good surface finish. Machine has two position feeding and stock can be fed during index. The main toolslide is provided with end adjustment to assist setting up for components of similar design but of varying length. Collet capacity $\frac{1}{2}$ " dia. Length fed and turned 4". Speeds 4,340 to 321 r.p.m. Motor 15 h.p.



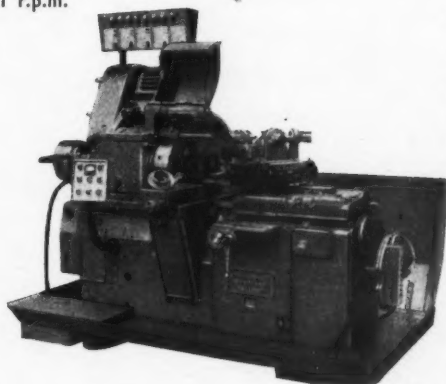
B.S.A. No. 4 centreless grinding machine with automatic sizing control and automatic infeed. In this set-up special bolts $\frac{7}{8}$ " x $2\frac{1}{2}$ ", fed from vibratory type hopper, are ground to a tolerance of 0.0005"; 700 per hour.



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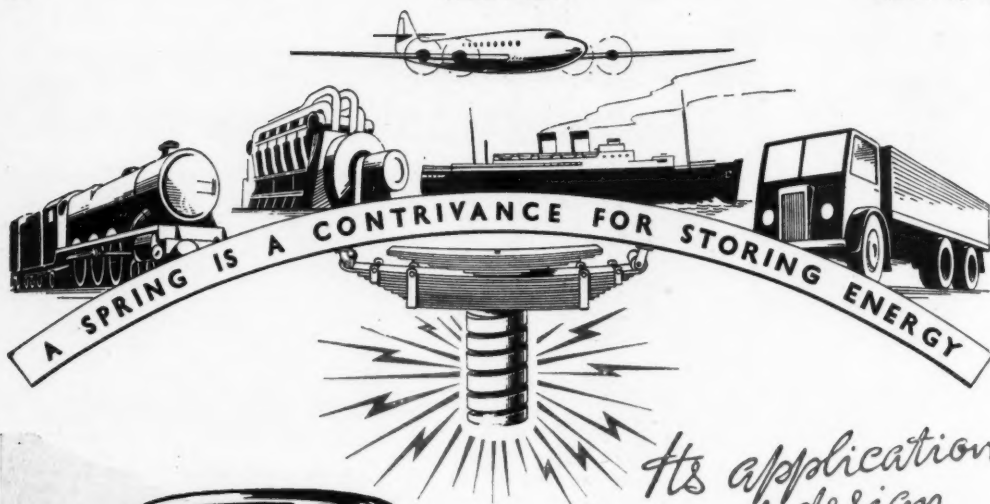
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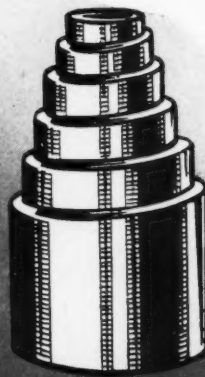
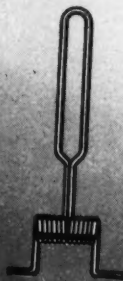
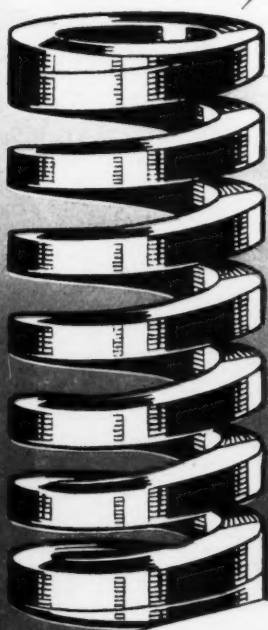
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The **FIMAP.**

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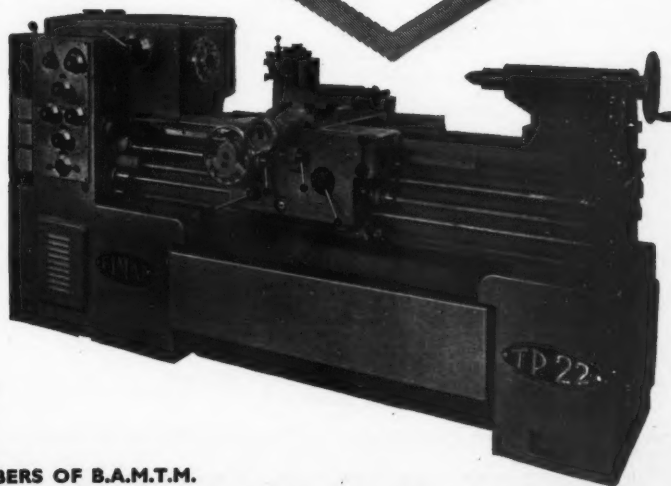
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- Mechanically pre-selected feeds.
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- Hardened and ground gears.
- QUICK DELIVERY

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3ft. 9 in. or 5ft.
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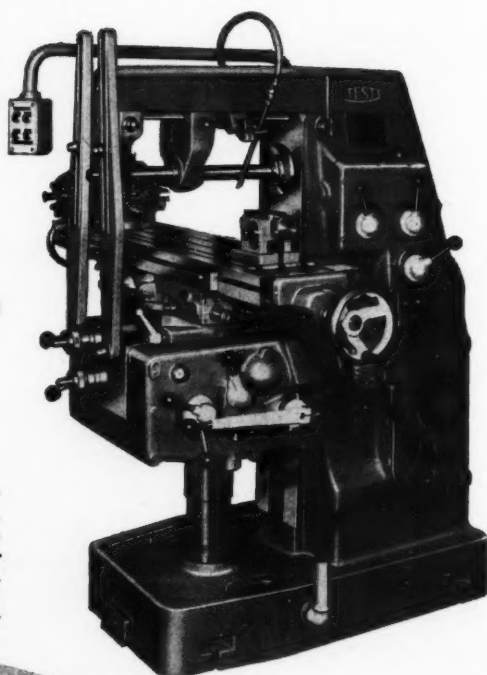
Table:	Working surface	..	48in. by 11in.
Table Feeds:	Longitudinal	..	29in.
	cross (without brace)	..	9in.
	vertical	..	17½in.
Spindle:	Spindle Nose	..	No. 40 N.S.
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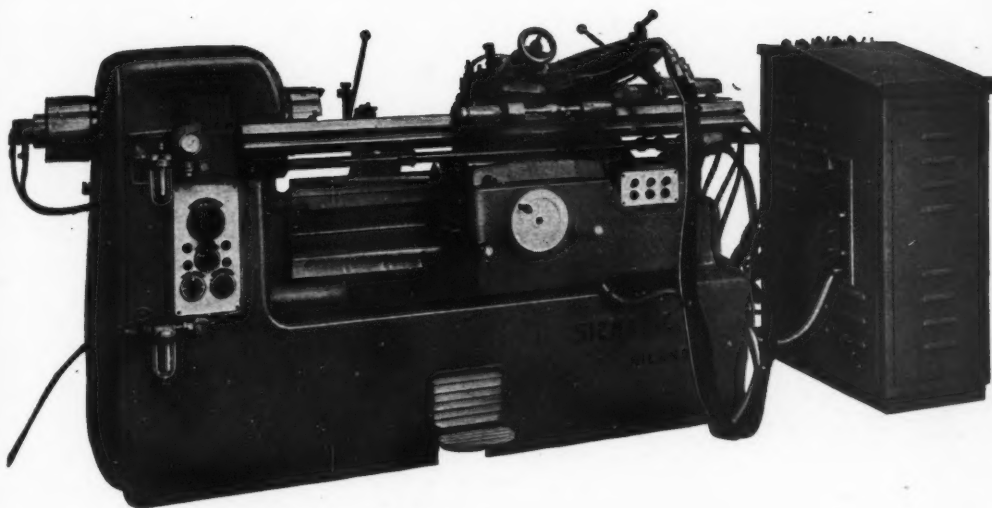
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Hardened Bed Slideways.
Auto cycling up to six depths of cut.
Hydraulic tailstock for drilling and boring.
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Eight models to choose from.

Basic price under £2,000.

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Max. swing over bed	..	15½ in.
Max. swing over saddle	..	9½ in.
Max. length turned	..	27½ in.
Hydraulic traverse of copying slide	..	4 in.
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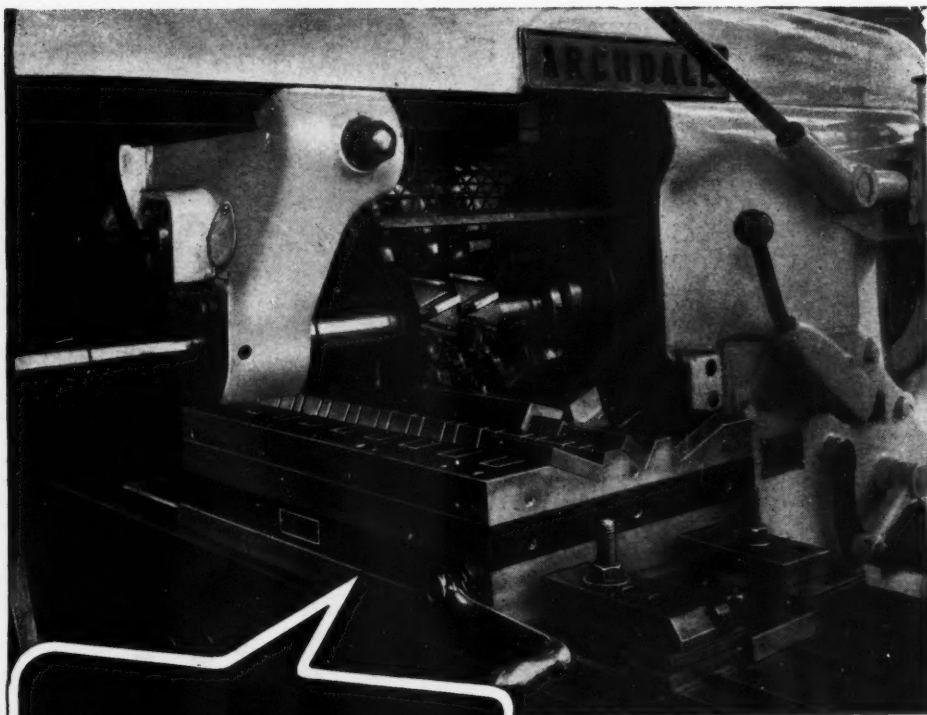
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Expert advice is available to you without obligation.



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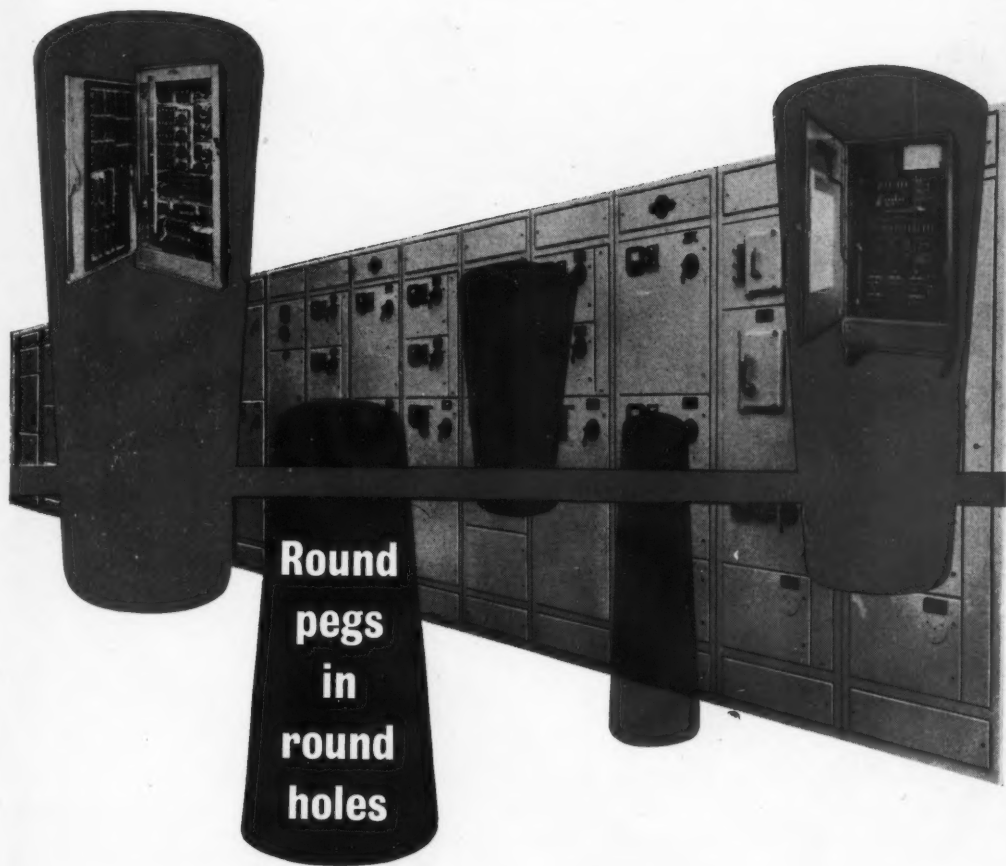
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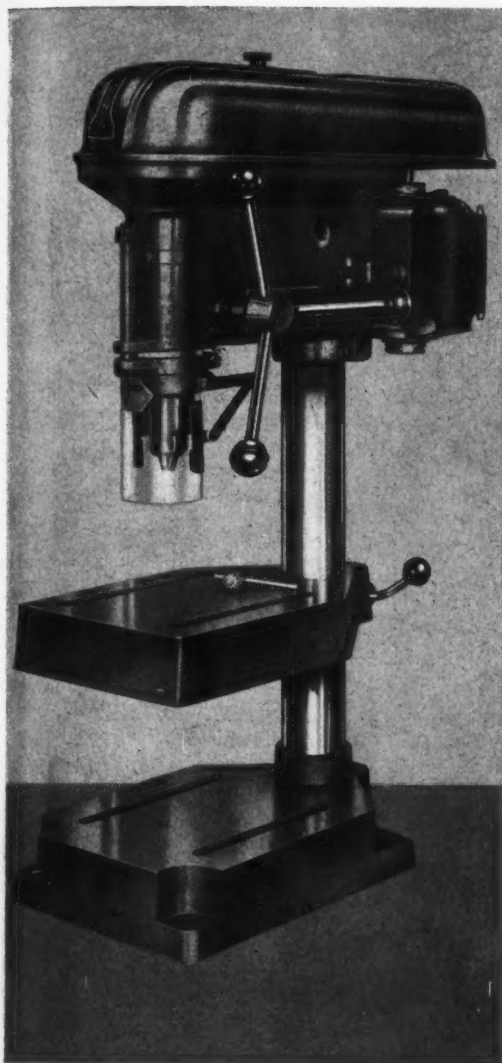
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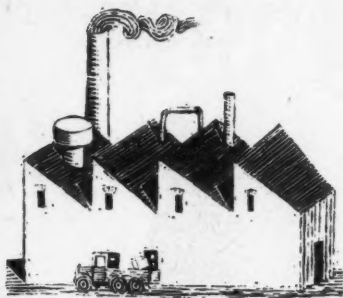


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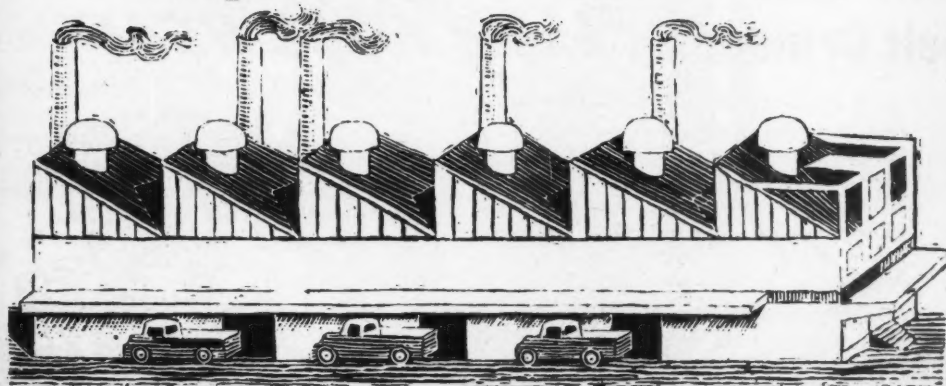
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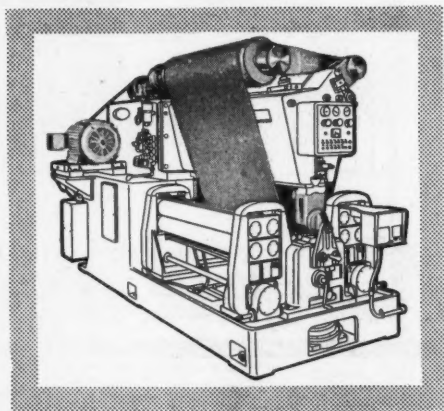


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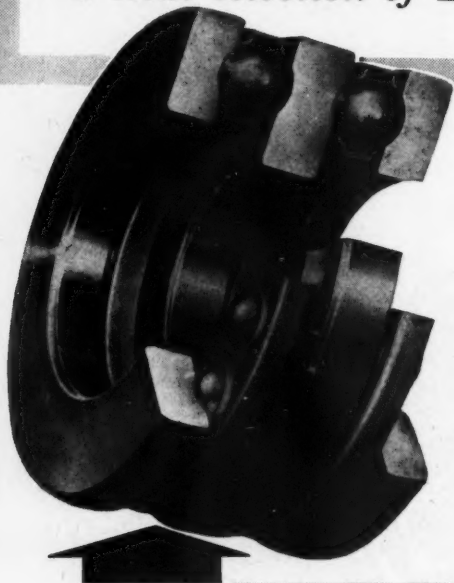
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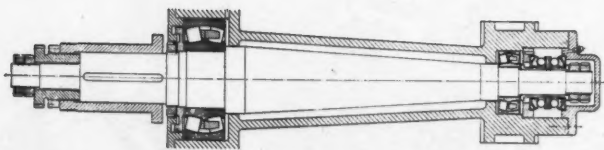
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MACHINERY

A JOURNAL OF METAL-WORKING PRACTICE & MACHINE TOOLS

Vol. 98, No. 2520

March 1, 1961



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Abstracts of Principal Articles

Sewing Machine Production in Japan P. 468

A brief history of the production of sewing machines in Japan is given, also some information on the present state of the industry. Reference is then made to the factory at Wakayama, near Osaka, of one of the largest sewing machine manufacturers, the Mitsubishi Electric Manufacturing Co., Ltd. This factory has an output of about 12,000 machines per month, most of which are of the domestic straight-stitch type, although a considerable number of industrial machines, and some of zig-zag stitch type, are also made. Line production methods are employed, and some of the operations on a typical arm casting for a domestic straight-stitch machine are described, including milling, drilling and fine-boring. Many of the machine tools employed are of standard design, or are made up in the company's tool room, for special-purpose applications, parts from obsolete machines being frequently incorporated. (MACHINERY, 98—1/3/61.)

The Production of F.H.P. Electric Motors P. 478

In this second article describing some of the methods employed at the factory of Hoover (Electric Motors), Ltd., Cambuslang, Lanarkshire, Scotland, reference is made to the machining of Mark II end-frames on Ryder Verticalauto machines. Insulating material is inserted in the winding slots of Mark II and Mark IV stators on Statomat automatic machines, and other automatic machines of the same make are employed for lacing the winding evolutes, *in situ*. For impregnating the Mark II stator windings, a special method is used, to avoid contamination of the outside of the shell with varnish. After impregnation of the windings, the stator bores are sized by roll burnishing, and the spigots for the end-frames are machined on a Drummond Maximinor multi-tool lathe. Universal motor commutators are slotted on fully-automatic E.M.I. electronically-controlled machines, three of which are tended by each operator. The final assembly and electrical testing of Mark II motors are also discussed. (MACHINERY, 98—1/3/61.)

Explosive Forming of Missile Components P. 486

Work carried out by Rocketdyne, Division of North American Aviation, Inc., U.S.A., has indicated that explosive forming is an economical method for producing missile components, which permits full

realization of metallurgical properties of the work material, particularly the high-temperature and high-strength alloys. For long production runs, steel, Kirksite and reinforced plastics dies are used, but if only a few parts are required, inexpensive, plastics lined concrete dies may be employed. Explosive forming has been applied to all major parts of missiles, also to the production of mandrels for assembly operations. (MACHINERY, 98—1/3/61.)

A.E.I. Position Indicating Equipment P. 493

Position indicating equipment has recently been introduced by Associated Electrical Industries, Ltd., Electronic Apparatus Division, Leicester, whereby the position of a machine tool slide, for example, is shown by a set of dials, which may be located to suit the convenience of the operator and layout of the machine. Movement of the machine member is detected by a pinion that meshes with a precision rack, and angular displacement of the pinion is relayed to the dials by a pair of synchronous-link Magslips, operating on a frequency of 50 c.p.s. A receiver Magslip drives the pointers of the dials, and movement is indicated to 0.001 in., over a range from 0.001 to 999 in. (MACHINERY, 98—1/3/61.)

The Precise Measurement of Small Objects... P. 503

This article is concerned with the application of the principle of image splitting for accurate measurement of very small dimensions, such as diameters of tungsten wires of the order of 0.001 in. The principle is first explained, and the image-splitting eye-piece employed is then described. Next, the accuracy of measurement obtainable by this method is discussed, and it is explained that this accuracy is considerably greater than might be anticipated on the basis of the resolution limit for the equipment. Finally, some typical results and applications are considered. (MACHINERY, 98—1/3/61.)

IN FORTHCOMING ISSUES

A Brazilian machine tool plant—Producing rotors for gas test meters—Numerically-controlled machining operations at the Giddings & Lewis works—The use of speed factors in calculating the load-carrying capacity of helical gears—Turning operations on titanium billets

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL**Manufacturing Equipment and Living Standards**

Concern has recently been expressed in the U.S.A. regarding the intensive competition which manufacturers in that country are now experiencing in certain directions in their home market. More particularly, attention has been drawn to the very rapid developments that are taking place in some branches of industry in Japan, and the consequent growth in export trade, and it has been pointed out in this connection that there is a wide disparity between Japanese labour costs and those ruling in the U.S.A. Japan, however, is no newcomer to the ranks of the industrial nations, and although the living standards are certainly low in comparison with those prevailing in the United States, Sweden, the United Kingdom, and certain other countries, they appear to be rising fairly rapidly. In our opinion, the growing competitive power of Japanese manufacturers, which seems likely to become more pronounced, while partly due to the smallness of the average wage and the diligence of the factory workers, is increasingly attributable to the growth of mechanization in industry. It appears, moreover, that this process will be accelerated in the future, since production by member firms of the Japanese Machine Tool Builders' Association, which is estimated to have totalled £48.2 million in 1960, is scheduled to rise to £71.4 million this year, and to £89.6 million in 1962.

It must also be borne in mind that Japan is by no means the only country in which rapid advances in industrial production and in exports of manufactured goods are being achieved. During the period from January to September, 1960, for example, Italy increased her exports of manufactures by no less than 47.8 per cent as compared with the total for the same months of 1959, and for France the corresponding figure was 28.3 per cent. At the same time, there is every reason to suppose that, within a comparatively short period, some other countries, where manufacturing industry until recently was virtually non-existent, will cease to be importers, on balance, and will not only satisfy much of their own growing requirements, but will begin to compete in world markets.

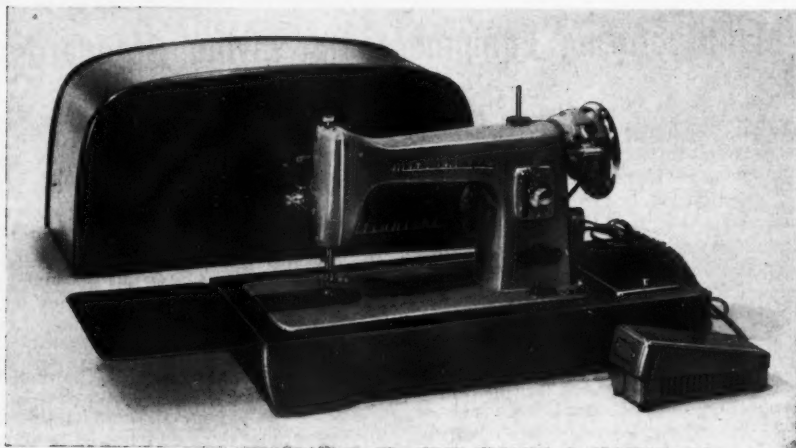
These rising industrial countries will have many problems to overcome in the initial stages, but they will also have the great advantage of being able to enter the field of manufacture without the incubus of vast numbers of obsolete machines and semi-derelict factory buildings. In this respect they will be in the same favourable position as a country

which has suffered great destruction in war, where many companies have been compelled to make an entirely fresh start. As in Japan, manufacturing concerns in the newly industrialized countries will also benefit in the earlier years from comparatively low wage rates compatible with the prevailing standards of living. It would be dangerous, however, to assume that on this account they will be content to equip their factories only with inexpensive, elementary types of machines. On the contrary, within the financial limitations under which they will be operating, they are likely to seek the most efficient plant obtainable.

Under the changing conditions of world trade, the course that must be followed by some countries where large scale industry has long been established is clear, if the favourable living standards that have been built up over many years are to be preserved. Manufacturing methods, on average, must be constantly improved to maintain a level of productive efficiency that will ensure ability to compete effectively in spite of high wages and short working hours. There is no other way. The first requisite is a steady flow of new machinery and equipment of the most highly developed types—and particularly of new machine tools—in adequate volume, into factories throughout a country. A supply of machinery will not alone suffice, however, since it is also necessary, if collective and individual prosperity are to be maintained, that both management and labour should ensure that it is used consistently to the best advantage. Clearly, moreover, it cannot be so used if it is caused to stand idle at the whims of economic policy.

The more highly mechanized an industry or a factory has become, the greater is the cost of further advance, but in the face of growing competition from many quarters this is a price that must be paid. From this standpoint it is worth while to enquire what is being done to keep machine tool equipment in the U.S.A. up-to-date in the face of the inroads which imported manufactured goods are making in the home market. Although an important exhibition was held last year, which revealed many striking advances in machine design, with the possibilities of very substantial savings in cost, particularly in the fields of medium and small quantity production, net new orders placed with American machine tool builders (653.4 million dollars) were somewhat lower than in 1959. Of

(Continued on page 510)



Sewing Machine Production in Japan*

Methods Employed by Mitsubishi Electric Manufacturing Co., Ltd., Wakayama

By R. E. GREEN, Associate Editor

ACCORDING TO A WHITE PAPER on "The Growth and Structure of the Machinery Industry in Japan," recently published by the Japanese Ministry of International Trade and Industry (M.I.T.I.), the number of separate enterprises producing sewing machines in Japan is 624. A total of about 26,600 people are employed in the sewing machine industry, but ten companies are responsible for 52 per cent of the total output, and of these, five account for about 36 per cent of the total.

Sewing machines now being built in Japan include household and industrial types, and some 4,000 different designs of machine are in current production. These designs cover lock- and chain-stitch machines of both straight and zig-zag types,

also electric seam-welding machines for "sewing" plastics sheets.

The first sewing machine was imported into Japan in 1860, and an importer of a German product succeeded in making such machines for the first time in Japan in 1881. A patent covering the Koide-type sewing machine was granted to Shinjiro Koide in 1911, and, in 1915 and 1920, Tadatashi Amari and Toyoji Akearashi invented other machines. It was not until 1921, however, that the manufacture of sewing machines was started by the Pine Sewing Machine Co., Ltd., some 76 years after the original invention of such machines in the U.S.A. Another company, the Teikoku Sewing Machine Co., started making sewing machines in 1923, but the growth of the industry, in competition with the well-established Singer company of America, was very slow, and the annual production rate was still less than 2,000 machines in 1931.

Subsequently, the growing home industry was encouraged by the introduction of a protective tariff, and in 1932 several other companies, including the Mitsubishi Electric Manufacturing Co., Ltd., and the Brother Sewing Machine Manufac-

* Articles on the Japanese metal-working industries which have already been published in MACHINERY have been concerned with the 4th Osaka International Trade Fair, 96/1212-1/6/60 and 96/1288-8/6/60; Motor Car Production in Japan, 96/1426-15/6/60, 96/1552-22/6/60 and 96/1640-29/6/60; Bicycle Production in Japan, 97/46-6/7/60; Refrigerator Production in Japan, 97/416-24/8/60 and 98/176-25/1/61; Electric Motor Production in Japan, 97/708-28/9/60, 97/1276-7/12/60 and 97/1448-22/12/60; Television Receiver Production in Japan, 97/882-26/10/60; Transistor Production in Japan, 98/253-1/2/61.

The Machine Tool Industry of Japan, 97/108-13/7/60; Japanese Machine Tool Factories, 1. Ikegai Iron Works, Ltd., 97/304-10/8/60, 2. Okuma Machinery Works, Ltd., 97/472-31/8/60, 3. Toyoda Machine Works, Ltd., 97/652-21/9/60, 4. The Kawasaki Works of Hitachi, Ltd., 97/1048-9/11/60, 5. Mitsui Precision Machinery & Engineering Co., Ltd., 98/408-22/2/61.

turing Co., Ltd., entered the field. Restrictions were imposed on the importation of sewing machines in 1938, and imports were completely banned the following year. As a result of this action, the annual production rate, which had grown to 50,000 machines in 1937, expanded rapidly to 160,000 in 1940. During this period, the number of enterprises making parts and complete sewing machines rose from 137 to 194, the number of their employees from 4,600 to 5,300, and the number of machines exported, from 7,000 to 10,000.

War-time restrictions resulted in many amalgamations and changes of product, and by 1942, there were only nine makers of machines, and 12 suppliers of parts. In 1943, the production and sale of domestic sewing machines was banned completely, production of leather-sewing machines only being permitted. After the war, the industry was gradually revived, and its growth was strongly stimulated when, in 1948, under the guidance of M.I.T.I., standards for many of the parts employed in the conventional straight-stitch type of machine, then being made, were established. This standardization made it possible for many small enterprises, not capable of producing complete machines, to produce standard parts, or to buy such parts from other firms for assembly into machines of their own design and manufacture.

At the present time, it may be noted, of the 121 companies producing complete sewing machines, about 100 continue to employ standard parts, and their combined production amounts to some 50 per cent of the total number of sewing machines made in Japan. Details of the increase in the numbers of sewing machines produced in Japan in the years since the war are given in the table, from which it may be seen that expansion has been both rapid and continuous. A high proportion of the machines produced (97 per cent in 1958) were of the domestic type, and it may be noted that the value of the domestic machines made in that year is given as £16,396,000, the corresponding figure for industrial machines being £1,302,000.

From these figures, it appears that the average value of a Japanese domestic sewing machine is about £7.4, and that the export of some 75 per cent of the production of the entire industry in 1958, represented earnings of the order of £13 million. Figures for 1959 show that 2,140,000 machines were exported—about 23 per cent more than in 1958—and the increase was mainly due to a substantial rise in the number of zig-zag type sewing machines exported to the U.S.A. in that year. As a result of difficulties which have been encountered in connection with the export of sewing machines, export quotas have been established

for individual manufacturers, and an inspection organization has been set up, to which all machines must be submitted before they leave the country, to ensure the maintenance of certain standards of finish and quality.

About 60 per cent of the total number of Japanese domestic sewing machines produced are of the conventional, and 23 per cent of the link-motion type, the remaining 17 per cent being designed for the production of embroidery patterns of varying degrees of complexity, by lateral movements of the needle and shuttle mechanism, which are obtained either semi- or fully-automatically.

The number of different types of industrial sewing machines now approaches 100, and others are still being developed, sewing rates having been increased from 3,000 to between 5,000 and 6,000 stitches per min. during recent years. These developments have been accompanied by provision for pressurized lubrication of the machine mechanisms.

Most of the makers of complete sewing machines are established in the three large towns of Tokyo, Osaka and Nagoya, although some of these firms produce only the machine mechanism or head, and sell to other companies which are responsible for fitting them into cabinets and marketing. Because sewing machine parts are light in weight and are made to recognized standards, it has been possible for them to be produced in small shops, scattered widely throughout the country, and the industry benefits from this use of cheap local labour. Standardization allowed many small and medium-sized companies to enter the field, complete machines being assembled from parts and sold both in the home and export markets.

The Japanese Sewing Machine Association, which has 88 member firms—mainly those operat-

TABLE SHOWING THE NUMBERS OF DOMESTIC AND INDUSTRIAL SEWING MACHINES PRODUCED IN JAPAN, THE TOTAL NUMBERS EXPORTED AND THE PERCENTAGES EXPORTED FROM 1945 TO 1958

Year	Domestic machines (1,000's)	Industrial machines (1,000's)	Total (1,000's)	Machines exported (1,000's)	Percentage of production exported
1945	2	2	4	—	—
1946	37	9	46	0-048	—
1947	134	13	147	2-784	0-5
1948	166	14	180	18-454	10-2
1949	274	25	299	97-233	32-4
1950	494	20	514	408-411	79-4
1951	1,030	49	1,079	852-651	61-4
1952	1,260	62	1,322	881-575	66-6
1953	1,318	76	1,394	818-350	58-4
1954	1,372	67	1,439	1,215-689	84-4
1955	1,696	107	1,803	1,535-862	85-1
1956	1,722	176	1,898	1,484-758	78-3
1957	2,172	74	2,256	1,745-329	77-3
1958	2,216	69	2,285	1,731-826	75-7



Fig. 1. Examples of finish-machined arm castings for Mitsubishi sewing machines of the straight-stitch type, which are produced at the rate of about 8,500 per month in the Wakayama factory

ing on a comparatively large scale—includes only six with a capital of more than £100,000, and each of these firms make sewing machines only as a sideline to the main activities. Only 13 companies in the Association employ more than 300 people directly in the production of sewing machines and one of the largest of these is the Mitsubishi Electric Manufacturing Co., Ltd., whose factory is at Wakayama, on the shores of the Kii Strait leading up to Osaka Bay, and some 35 miles from Osaka. Reference has already been made in MACHINERY (97/416—24/8/60, 97/1276—7/12/60, and 97/1448—28/12/60) to the history of this company, and to some of the methods employed in Mitsubishi factories for the production of refrigerators and electric motors. Here, the Wakayama factory, and some typical machining operations on sewing machine components, are discussed.

THE MITSUBISHI WAKAYAMA SEWING MACHINE FACTORY

The Mitsubishi factory in which sewing machines are now produced was purchased from the Showa Spinning Co. about 18 years ago, and has a floor area of some 495,000 sq. ft., most of the buildings being of traditional wooden construction. Of this area, about 135,000 sq. ft. is devoted to offices, stores and dwelling or apartment houses for the workers, leaving approximately 360,000 sq. ft. for production facilities. After the war, the factory was at first concerned with the production of

electrical equipment such as pole transformers, which are widely used in Japan, and motors for opening and closing mechanisms on railway carriage doors. The manufacture of sewing machines, which had been carried on in a factory at Nagoya since 1930, was transferred to the Wakayama factory in 1950, and was the main activity there until 1956.

Other equipment, including refrigerator compressor units of 1½ to 7½ h.p., refrigerated open-type cabinets and show-cases, and milk and water-cooling units, was introduced in 1956, and is still in production.

About 850 people are employed in the Wakayama factory, of whom some 170 are engaged in the manufacture of refrigerating equipment, and about 680 in the production of sewing machines. A representative example from the extensive range of machines made by the company, which includes straight- and zig-zag stitch domestic, and a number of industrial designs, is seen in the heading illustration. This machine is of the straight-stitch type, with cast iron head and bed, and the driving motor is mounted on a bracket on the far side of the column.

Sewing machines of the type illustrated account for the greater part of the output of the Wakayama factory and are made at the rate of about 8,500 per month. The cheapest of such machines sells for the equivalent of about £21 in Japanese shops. A further 500 machines of the zig-zag-stitch type are also made per month, and an approximate price for a hand-operated, semi-automatic machine of this type, in Japan, is £31. Fully automatic zig-zag machines sell for up to £40 on the home market. Industrial sewing machines, of several different designs, are also made at the rate of about 2,000 per month. Most of the parts employed in Mitsubishi sewing machines are made in the factory, especially those for zig-zag and industrial machines, but straight-stitch machines incorporate several standardized parts such as shuttles, bobbins, needle-bars and balance wheels, which are purchased from outside suppliers. Standard parts made in the factory include such components as

needle plates and pressure feet.

Few die castings are at present incorporated in Mitsubishi sewing machines, and this process is mainly employed for simple cover castings, which are bought from specialist firms. Iron castings are supplied to the factory from a subsidiary company at Kuwana, a town near Osaka. Equipment in the factory consists mainly of standard machine tools, certain of which have been specially adapted for difficult operations, or machines built up from old, otherwise obsolete plant. The machines are built in the company's own tool room, and a staff of eight people is employed on jig, fixture and special machine tool design. There are also a few well-designed special-purpose machines supplied by Japanese companies, but most of the plant appears to be at least 15 to 20 years old.

The plant installed includes about 650 machine tools, and there is also much other equipment for such work as pressing, forging and welding. Production quantities for straight-stitch



Fig. 3. Another view of the machine in Fig. 2, showing the loading station, at the left, and details of the clamping arrangements for arm castings. The machining time per casting is 1.92 min.

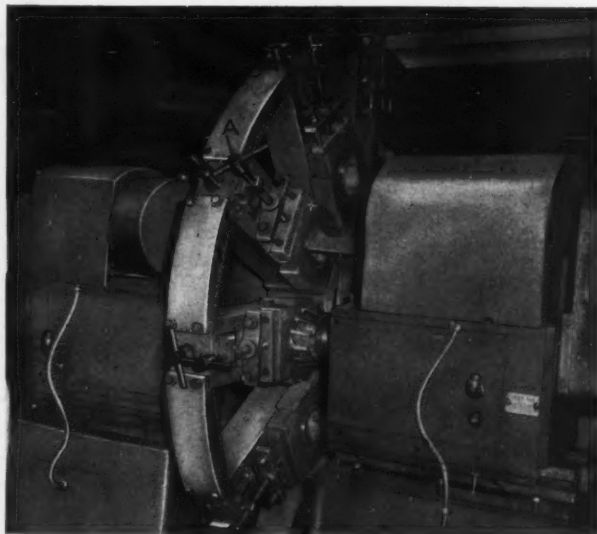


Fig. 2. At the first operation on arm castings, on a typical line, the cover face, and the column mounting face, are milled on this rotary-drum type machine which was designed and built by the company

machines are ample to justify the use of line methods, and each line of machines has a low, sheet metal-covered trough, along which the castings are moved from one operation to the next, by hand.

MACHINING OF ARM CASTINGS

Sewing machine arm castings are received at the factory in the fettled and buffed condition, and examples of finished castings are shown in Fig. 1. The first operation on such a casting, on a typical line in the factory, is performed on a special rotary-drum type milling machine, a rear view of which is given in Fig. 2. This operation consists of straddle-milling a cover-face and the column mounting face, at the top and bottom of the casting, respectively. Built in the company's own tool room, this machine has two spindle heads, each clamped in a fixed position on a slide-way at one side of the central drum-type fixture. The spindles of the unit heads are driven at 200 r.p.m.,

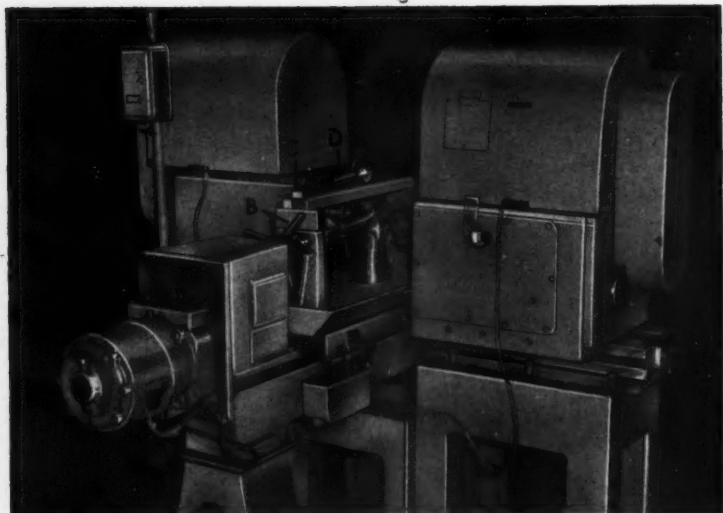


Fig. 4. Also built by the company, this duplex machine has two unit heads with cutters of 4.92 in. diameter, and mills faces surrounding apertures at each side of the column portion of the sewing machine arm casting

cutters are so spaced that the casting is machined to an overall height of 183.8 mm. (7.2363 in.). Loading and unloading of castings is performed continuously at the front position shown in Fig. 3, and the machining time per casting is 1.92 min.

SPECIAL DUPLIX MILLING MACHINE

Another special-purpose milling machine, designed and built by the company, is employed for machining faces, surrounding apertures for the stitch-setting lever and for mechanism - adjustment purposes, at the front and rear of the column, and is seen in Fig. 4.

This machine has a bed and they are fitted with 6-in. diameter, carbide-tipped inserted-blade milling cutters, each with 16 teeth.

The drum type fixture, also seen in the view of the front of the machine in Fig. 3, is carried on large-diameter trunnion bearings, one of the trunnions being provided with a spring-loaded brake which smooths out variations in the speed of rotation of the drum due to variations in the areas of contact between the cutters and the work. The drum has 14 clamping positions in which the castings are loaded, each with the column end towards the centre of rotation. A circular cast crankshaft bearing boss on the casting is engaged by a female centre in the end wall of the fixture, and the lower portion of the column is gripped between profiled faces on two jaws. These jaws are brought together by tightening the large hand-screw A, Fig. 2, movement being transmitted to the lower jaw through a draw-bolt at each side.

The needle-bar end is engaged by a screw-down block with vee faces, which apply pressure to thrust the casting against the female centre, and the block is also provided with projections extending over the top and bottom surfaces to centralize the casting at that end. The drum is driven at a speed which provides a feed rate of 3.94 in. per min. at the centre of the column face, and the

weld-fabricated from angle-section steel, with slide bases on which unit heads, of similar design to those on the previous machine, are carried in fixed positions. The spindles of these heads are fitted with cutters of 4.92 in. diameter similar to those employed on the first machine, and are driven at 150 r.p.m. The heads are set to a spacing of 73 mm. (2.874 in.), to suit the distance between the two faces to be milled.

Between the unit heads is mounted the bed from a disused lathe, fitted with a feed gearbox at the end in the foreground. The bed-ways carry a table, that is advanced at a rate of 3.35 in. per min. by a screw coupled to the gearbox, and the table supports a fixture to hold the casting. In this fixture, a female centre is again used to locate the casting laterally, at the column end, from the circular cast crankshaft boss, and it rests on the machined column face. At the needle-bar end, the casting is engaged by a stirrup, which is advanced by a screw turned by the capstan B, to thrust the casting towards the female centre. A screw on the stirrup can be tightened to clamp the needle-bar end of the casting against a fixed face on the far side of the fixture.

Clamping pressure is also applied by a pivoted beam, seen in position above the casting, which can be raised for loading and unloading when a T-piece C is turned into alignment with its slot. In

the position shown, pressure is applied to the top of the casting by means of a universally-jointed pad on the end of a vertical screw, fitted with a pivoted tightening lever *D*. The machine operates on an automatic cycle, started by push-button, which provides for fast approach, slow feed, fast return and stop, movements of the table being selected by stops and limit switches at the side.

Two other machines are employed for this operation, one of them being a horizontal milling machine of conventional design, fitted with a two-spindle adapter. A single operator tends the three machines, also the first, drum-type machine, so that the two operations are included in the same time cycle.

A standard centre lathe is then employed to

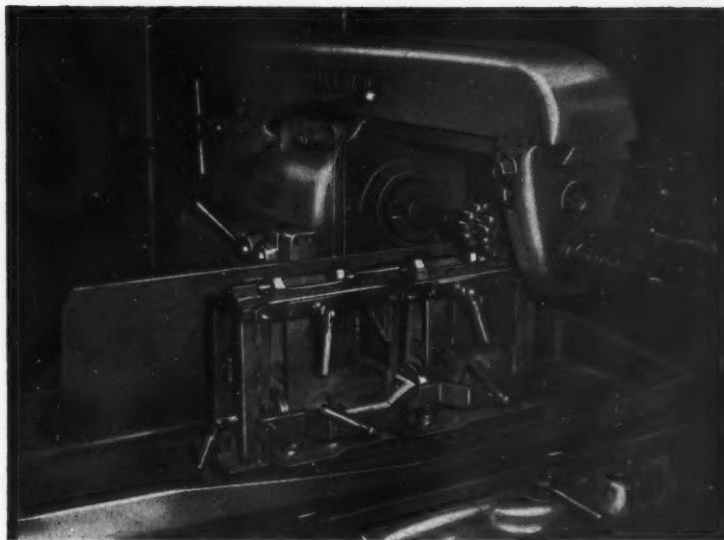


Fig. 6. Flat faces at three different levels on the needle-bar end of the arm casting are milled, on two castings at one setting, with this set-up on an Osaka Kiko machine

machine the circular crankshaft boss, which is turned to a diameter of 31 mm. by 15.5 mm. long (1.2205 by 0.6102 in.), face the end, and take a facing cut at the position where it joins the casting. Another milling operation follows, on the plain horizontal machine shown in Fig. 5, made by the Koaa Machine Works (no longer in business), and provides for machining faces on either side of the lower, and on the under-side of the upper, projections in which holes for the needle- and pressure-bar are subsequently bored. The casting is held in a horizontal position, resting on the previously milled stitch-regulating lever face, with the column-end face in contact with a vertical wall of the fixture.



Fig. 5. A standard plain milling machine, of Japanese make, is employed, with a 3-cutter gang, for milling two sides of the lower, and one side of the upper, projections in which the needle- and pressure-bar bores are later machined

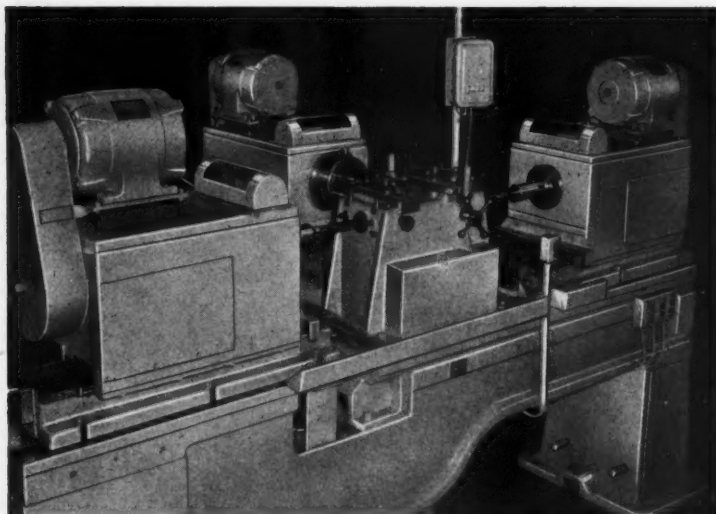


Fig. 7. Incorporating a bed from a disused lathe, this special 3-way machine rough-drills the two crankshaft bores, and drills three tapping-size holes in the column mounting face

A screw, turned by the handle *E*, thrusts the casting to the right, into contact with this wall, and a second screw, with a knurled head *F*, applies pressure to push the needle-bar end of the casting against a stop on the fixture base. Clamping pressure is also applied to the top of the arm by a pivoted strap, held down by a screw *G*, in a pivoted nut. When this strap is in the raised position, it may be noted, it is supported by the stop *H*, so that it remains readily accessible. Three side and face milling cutters, of 3.54, 3.94 and 4.92 in. diameter, are mounted on the arbor, and are driven at a speed of 81 r.p.m.

Two of the cutters are separated by a distance of 15 mm. (0.59 in.), and the distance between the two internal faces machined on the casting is 95 mm. (3.74 in.). The machine is operated entirely by hand, the table being traversed to the cutting position and fed up to a stop, then retracted for unloading. A second fixture, of similar design, on the far end of the table, is unused, but was originally provided to enable pendulum-milling to be carried out.

Next, the end faces of the needle- and pressure-bar projections are form-milled on the plain horizontal machine in Fig. 6, built by the Osaka Kiko Co., Ltd., Toyosaki, Oyodo-ku, Osaka. Two castings are accommodated in basically-similar fixtures on this machine, each with the needle-bar end upwards and with the column end in contact with a vertical face. In this position, each casting rests on the end of the crankshaft boss, on a pad which forms part of the fixture base, and the needle-bar

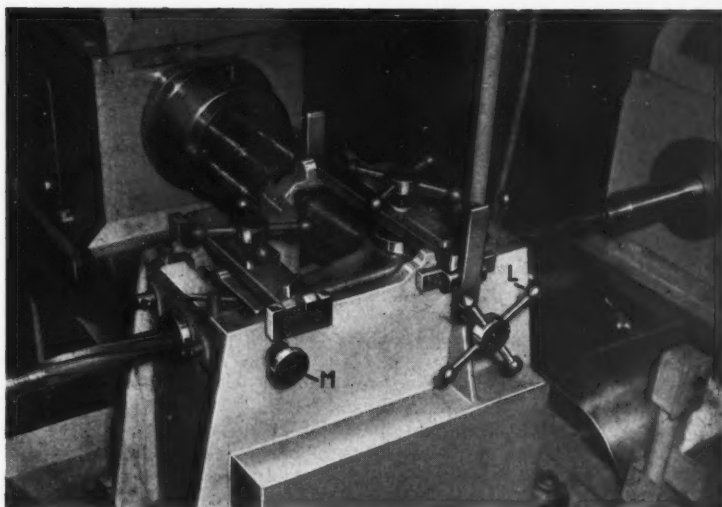
end is located by adjustable stops at each side. Pressure is applied to clamp the column end against the fixture face by a pad attached to a screw which is advanced by the handle *J*, for the casting at the left-hand end of the fixture, and

by a nut *K*, which has holes for the insertion of a tommy bar, for the casting at the right.

Screw-operated clamps, carried in pivoted straps, are applied at the top and bottom of each casting to hold it against adjustable faces on the far side of the fixture. The straps are held in place by T-headed pins which are turned into alignment with slots when the straps are being moved into and out of position. In Fig. 6, and in other illustrations in this article, guards have been removed to show the cutters more clearly. Previously, special form-relieved type cutters were employed to produce the required curved-shoulder profiles on the casting projections, as seen in Fig. 1, with radii of 8 mm. (0.315 in.), and a width of 32 mm. (1.259 in.) by 15 mm. (0.59 in.) high.

Recent modifications in the foundry techniques employed for these castings, coupled with the fact that the projections are covered by a smoothly-rounded casting on the completed machine, has enabled the curved surfaces of the projections to be left in the as-cast condition, so that the need for expensive form-milling cutters is avoided. The castings seen on the machine in Fig. 6 are of this type, and the arbor is therefore fitted with three plain cutters of 4.53, 3.54 and 4.72 in. diameter, which produce flat faces on the ends of the projections and at each side, at different levels. The cutters are driven at 105 r.p.m., and the table is fed at 2.126 in. per min., for this operation. The two last-mentioned milling machines, also the lathe, are tended by a single operator, and the cycle time for each is 2.1 min.

Fig. 8. Close-up view of the fixture on the machine in Fig. 7 showing the method of locating and clamping the arm casting, which is held in a horizontal position with the column mounting face to the rear



SPECIAL THREE-WAY DRILLING MACHINE

The next operation provides for drilling the crankshaft bore and three tapping-size holes for the holding-down bolts in the column end face, and is performed on the special machine shown in Fig. 7. Like that shown in Fig. 4, this machine is of the company's own design and construction, and it incorporates the bed and support legs of an old Ikegai lathe. The fixture is secured to the bed-ways at the centre, and at each side there is a standard unit head with a cam-operated automatic cycle. These heads are fitted with drills of 27 and 17 mm. (1.063 and 0.669 in.) diameter for the bores at the needle-bar and column ends of the arm, respectively, and the automatic cycle provides for fast approach,

drilling at a slower feed rate and rapid withdrawal,

A third head, of similar type, is supported on a weld-fabricated base at the rear, and is fitted with a 3-spindle adapter, each spindle carrying a 6.5-mm. (0.256-in.) diameter drill. Details of the fixture may be seen in the close-up view in Fig. 8, and the casting is held in a horizontal position with the column end-face against a vertical bush-plate at the far side. A pad, advanced by the capstan *L*, thrusts the casting towards this bush-plate. A second pad, at the right-hand end of the fixture, is applied by means of a similar capstan to push the casting to the left, so that the machined faces at the needle-bar end are pressed against datum surfaces.

These datum surfaces are provided on two



Fig. 9. Crankshaft holes at each end of the casting are fine bored on this Toyota machine, of conventional design. The hydraulically-operated table is moved first to the right and then to the left, in an automatic cycle

grooved locating pieces which engage the needle- and pressure-bar projections, and there are two knurl-head screws, as at *M*, whereby clamping force can be applied at each side of the casting at this end. Two pivoted straps are brought down over the casting and secured by T-pins, and pads carried by these straps are applied by means of the capstans shown, to complete the clamping of the casting. The automatic cycle is started by pressing a push-button, and after the heads have completed their sequences of movements the machine is stopped automatically, ready for unloading the workpiece.

FINE-BORING THE CRANKSHAFT BORES

The two holes for the crankshaft are next fine-bored to diameters of 27.75 and 17.75 mm. (1.0925 and 0.6988 in.) on the double-ended machine shown in Fig. 9, which was built by the Toyoda Machine Works, Ltd. Of conventional layout, this machine has a hydraulically-operated table which moves beneath a bridge-member at each end, carrying a spindle head. The table has an automatic sequence of movements, including fast

traverse to the machining position at the right, slow feed at 5 in. per min. for the boring operation, and rapid return. This sequence is immediately repeated for the boring operation at the left, after which the table is returned to the central position for reloading, all the movements being controlled by dogs on the front edge.

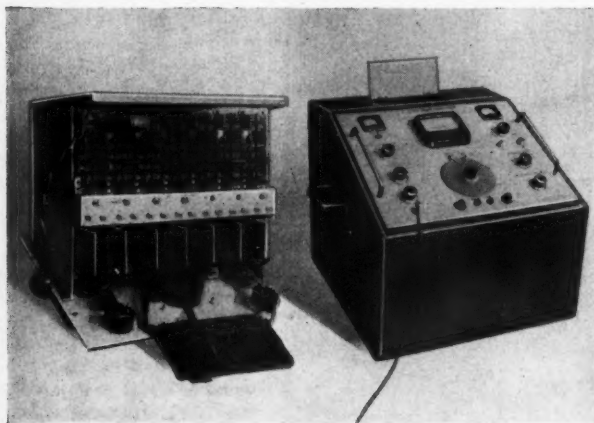
In the fixture, the casting rests on the column mounting face and is located by the drilled holes, and by the milled projections at the needle-bar end. A light clamping force is applied to this end from the far side by a screw, and a pivoted strap carries a screw-down clamp which is applied above the column end. Each of the boring spindles carries a single-point tool and is driven at 610 r.p.m., and the cycle time is 2.2 min. The fine boring machine and the drilling machine, described above, are tended by the same operator.

Further operations on arm castings, and on other sewing machine components, will be described in another article to be published shortly. Articles concerned with machine tool factories in Japan will also be included in forthcoming issues of **MACHINERY**.

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Fenlow Low Frequency Spectrum Analyser

An electronic spectrum analyser capable of analysing waveforms of vibrations, strains, and resonances as low in frequency as one cycle in three sec., and as high as 1,050 cycles per sec., has been developed by Fenlow Electronics, Ltd., Springfield Lane, Weybridge, Surrey.



Fenlow low-frequency spectrum analyser

The instrument, shown in the accompanying illustration, is fully transistorized and is transportable. It is suitable for operation on a 50-cycle a.c. supply of 200/240 or 110 volts. Essentially its function is to detect and measure hidden periodicities in waveforms and it can be fed with recorded information.

While the instrument was initially developed for Vickers-Armstrongs (Aircraft), Ltd., it is pointed out that it has applications in a much wider field of engineering. For example, it can be used in connection with the design of motor car suspensions, railway rolling stock, and hull structures of ships.

There is a meter on which is displayed the power of the random waveform in the pass band to which it is set, and facilities are provided for taking out the signal after the filter stage, for recording purposes. The frequency range is covered in five bands, and various filter widths are available.

Monitor points, to which access is gained by removing the top cover, enable six operational amplifiers in the instruments to be used for other purposes—for instance, to simulate the equations of a mechanical system.

Reilly Linear Displacement Transducers

A new system of high-accuracy linear measurement and position control has been developed by Reilly Engineering, Ltd., Forsyth Road, Sheerwater, Woking, Surrey. With this system, compact transducers are employed, which accurately measure linear displacement in conjunction with a null indicator.

The principle of operation, it is stated, combines the functions of length reference bars and the a.c. bridge, and as there are no moving parts other than the transducer head sliding on its shaft, a high degree of reliability in operation is ensured. When the instrument is set by hand, the position of the transducer head is ascertained by adjusting a number of decade switches until the meter reads zero. With the 10-in. transducer, for example, five switches are adjusted, the first one having ten steps of one inch, the second having ten steps of 0.1 in., and the last, ten steps of 0.0001 in. The operation takes approximately ten sec., and it is claimed that the accuracy achieved may be as close as ± 0.00002 in., with repeatability to 0.000005 in.

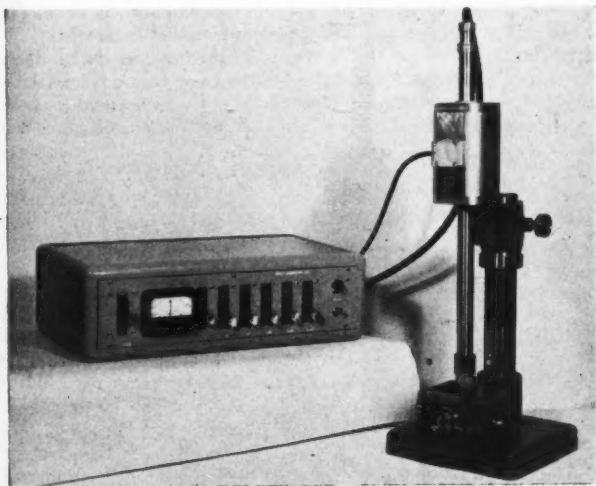
When the instrument is used for inspection purposes, the decade switches adjust themselves automatically as the transducer head is moved to each new position. This movement is effected in an

average time of $1\frac{1}{2}$ sec. In the accompanying illustration is shown a 10-in. range linear displacement transducer mounted vertically on a checking fixture, and connected to a hand-operated indicator bridge.

The system can be used to facilitate high speed production on various types of machine tools, including milling machines, jig borers and lathes. Developments are in progress to enable it to be employed on a lathe for screw cutting without a gearbox. In this application, setting for any pitch can be made rapidly by means of a series of decade switches which act as an electronic gearbox. It may be noted, moreover, that by employing two transducers which move in step, in any desired ratio, an electronic pantograph arrangement can be obtained. With such an arrangement, as a photo-electric transducer follows the drawing, its position is being continuously measured by a set of linear transducers, whereby a flame cutting torch or contour milling cutter can be caused to reproduce the drawing in the required ratio.

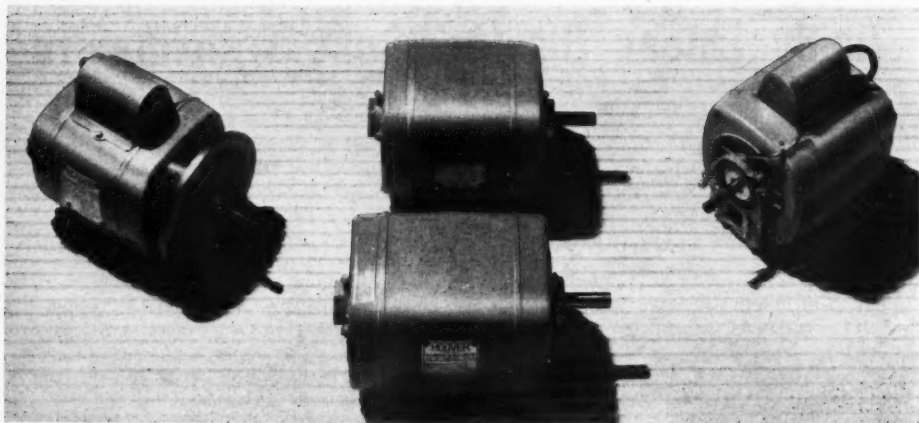
Various attachments can be used to facilitate the use of the transducers, such as a zero offset unit, with the aid of which the operator can set a work-piece in a convenient position and make all measurements with reference to the required zero position on the drawing. An indicator lamp unit which displays the measurements made, in large numerals, is also available.

Transducers can be supplied in a variety of types, for example, for measurements as large as 500 ft. and—at the opposite end of the range—for measuring, it is claimed, to 0.0000001 in. Advantage has been taken, in the construction of the instruments, of the latest developments in transistors and printed circuits.



A Reilly 10-in. range linear displacement transducer mounted on a checking fixture and connected to a hand-operated indicator bridge

INDUSTRIAL BUILDING. During the first nine months of 1960 approval was given for 2,427 new industrial buildings and extensions with individual areas "mainly over 5,000 sq. ft." The total area involved was 73,577,000 sq. ft. By comparison it may be noted that the number approved in the full year 1959 was 2,457 with an aggregate area of 58,429,000 sq. ft.



The Production of F.H.P. Electric Motors

Methods Employed by
Hoover (Electric Motors), Ltd., Cambuslang

By S. C. POULSEN, Associate Editor

IN AN EARLIER ARTICLE IN MACHINERY, 98/348—15/2/61, in which attention was drawn to some of the methods employed by Hoover (Electric Motors), Ltd., Cambuslang, Lanarkshire, Scotland, for producing components for their f.h.p. electric motors, particular reference was made to the Mark II and Mark IV industrial types. The production of laminations, on 5-stage press tools, was described, also lamination stacking, stator and rotor die casting, and the machining and grinding of rotor shafts. Here, some other typical operations on motor components are considered.

As already indicated, the shells of the Mark II motors are of die cast aluminium alloy, and the end-frames are of similar material. These components are machined in pairs on Ryder No. 6 Verticalautos, which are arranged for double indexing, and a representative set-up is shown in Fig. 1. At the end of each automatic cycle, when the heads are raised and the table is indexed, a pair of machined components is unloaded from the chucks at stations 1 and 2. Unloading and loading are facilitated by the power-driven runner seen at the left. One terminal end-frame, and one drive end-frame, are loaded into the chucks at stations 1 and 2, respectively. Each chuck has

two profiled jaws, and on the upper face of the body, there are three vertical pegs, as at A, that engage and locate the under-side of the work.

When the next automatic cycle is initiated, the chuck carrying the terminal end-frame is indexed to station 3, and that carrying the drive end-frame to station 4. Whereas the chuck at station 3 is held stationary, in a predetermined angular position in relation to the corresponding head, that at station 4 is run at 330 r.p.m. A multi-spindle head at station 3 drills seven holes, and clears a cored hole. Two of these holes are also spot-faced. At the same station, a boring-bar tool rough bores the bearing diameter to 0.766 in., and a 2-lip cutter, mounted in the same bar, counterbores the cover-plate housing 1.9 in. diameter by 0.2 in. deep, and faces the end of the bearing boss. Meanwhile, at station 4, a similar boring-bar tool is used to machine the bearing and cover-plate diameters on the drive end-frame.

At the next indexing movement, the terminal end-frame is carried to station 5, and the drive end-frame to station 6, and both chucks are run at 330 r.p.m. Here, multiple tools, as seen at B in Fig. 1, perform the following operations on both components: machine spigot face; counterbore spigot

Fig. 1. At this set-up on a No. 6 Ryder Verticalauto, arranged for double indexing, a pair of machined Mark II motor end-frames is unloaded every 62 sec.

diameter to 5.875 in./5.878 in., and chamfer; and finish bearing diameter to 0.781 in./0.779 in., and cover-plate diameter to 1.934 in./1.937 in. Finally, the components are indexed to stations 1 and 2, for unloading. At this set-up, a pair of machined components is unloaded every 62 sec.

INSULATING THE STATOR SLOTS

Strips of insulating material are inserted in the winding slots of certain types of stator stacks, on Statomat (Hanns Fickert, Frankfurt) automatic machines. These machines are also used for the corresponding operation on Mark IV stators, and a close-up view of a typical set-up is given in Fig. 2. The component to be insulated is placed on the mandrel C, the plain upper portion of which engages the bore. This portion is provided with four narrow projections D, which engage the gaps between the pole-pieces, and thus serve to locate the work, so that the slots in the component are aligned with those in the lower portion of the mandrel, as at E.

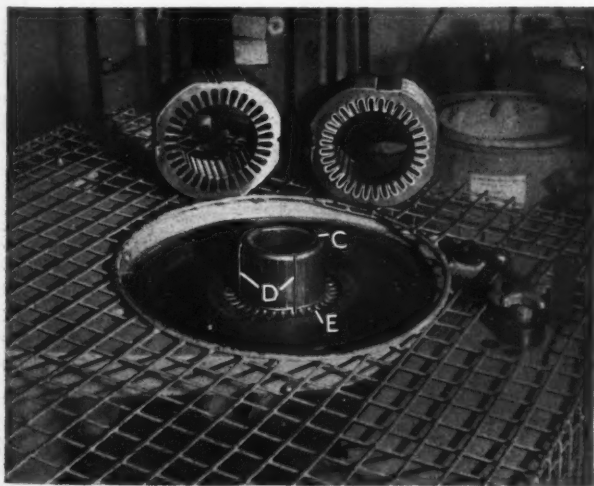


Fig. 2. Close-up view of one of the Statomat machines for inserting the insulation in the stator slots, showing the mandrel on which the work is mounted



When the automatic cycle is started, the mandrel and work are repeatedly indexed by one slot at a time, and as each slot, in turn, is aligned with a pusher mechanism below the mandrel, a preformed strip of insulating material is thrust into it. The insulating material is drawn from a coil (not visible) at the right-hand side of the machine, by two pairs of feed-rollers that operate intermittently, in unison with the pusher mechanism. After passing through the first pair of rollers, the strip travels between curved guides that turn over both edges. It is then drawn through the second pair of rollers, which smooth and flatten the folds.

The coil, and both pairs of rollers, are mounted with their axes vertical, and as the partly-formed strip emerges from the second pair of rollers, it passes across an aperture in the side of a vertical form-block. A horizontal slide, mounted in line with the aperture, carries a knife and a form-punch.

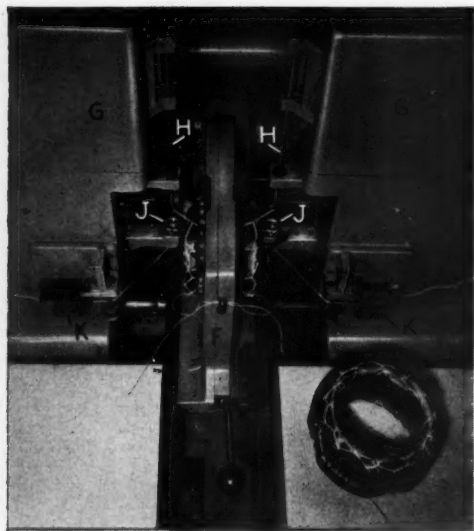


Fig. 3. Stator windings on certain types of motors are laced automatically on both sides on the Statomat machines here shown

When the slide is advanced, the knife cuts off a length of strip, and the punch thrusts it through the aperture, and forms it to a U-section, against a corresponding "die" portion of the form-block, with which the aperture communicates. Then, as the slide is withdrawn, the pusher thrusts the formed strip upwards, through a profiled vertical bore that forms a continuation of the die profile.

This bore, and the corresponding slot in the mandrel, constrain the limbs of the strip, so that it passes freely into the slot in the work. When thus released, the strip springs open slightly, so that it fits snugly against the walls of the slot, and the edges of the folded portions serve to locate it longitudinally against the end-faces of the lamination stack. When the strips have been inserted in all the slots, the machine stops, and the work is unloaded. The 32 strips of insulation are inserted in each Mark IV stator in a floor-to-floor time of 17 sec. Stators with different bore-diameters and numbers of slots are accommodated by the use of interchangeable mandrels, and by changing the setting of the indexing mechanism of the Statomat machine.

The methods employed for winding the stators of the various motors produced differ according to the design. For the majority of the motors, the coils are wound on stepped, square-section

mandrels, and are subsequently inserted in the slots, whereas for other designs, the coils are wound directly into the slots, on special Hoover machines. It may be mentioned, in the latter connection, that the type of insulation strip inserted on the Statomat machines described is of particular advantage where the coils are wound directly into the slots, since the double-thickness edges are of adequate strength to resist the pull of the wire, without damage.

STATOMAT LACING MACHINE

To facilitate the lacing of stator windings on certain motors, previously laced by hand, the company has recently installed a number of special-purpose Statomat machines that perform this work fully-automatically. A view of the working zone of one of these machines, set-up for Mark IV stators, is given in Fig. 3. The stator to be laced is placed in the fixture *F*, which is slid to the front for loading, and to the rear, against a stop, to locate it in the working position. To perform either of these movements, the operator depresses the spring-loaded lever seen at the front of the fixture, and when this lever is released, the fixture is automatically locked in position.

On either side of the fixture, there is a head *G*, which carries a hooked needle *H*, and a cup-shaped shuttle *J*. String is drawn from a spool mounted on each head, and passes through a tensioning device *K*, into the bottom of the shuttle *J*, whence it emerges through a hole in the wall of the cup, near the top. Initially, a length of the string is pulled through the shuttle, and the end is tied round one of the coils. A loop of the string is then hooked on to the needle *H*, and the automatic cycle is started. Thereupon, the following movements take place, in unison. The heads *G* move in and out; the needles *H* are raised and lowered, and turned at the bottom of each stroke; and the work is indexed.

As a result of this combination of movements, a series of interlocking loops is formed—in the same way as the stitches on a sewing machine—which pass round opposite sides of the coil alternately. On the upward stroke, the hook of each needle *H* pulls up a loop, and the inward or outward movement of the head wraps the loop partly round the coil. At the next downward stroke, when the needle is turned, the next loop is picked-up from the shuttle, and that previously formed is shed over it, and so on. When the work has been indexed through one complete revolution, the machine stops, the string is severed, the ends are tied off, and the work is unloaded. The lacing of each Mark IV stator, on both sides,

Fig. 4. This method of impregnating the stator windings of the Mark II motors is employed to avoid contamination of the exterior of the shells with varnish



is completed in a floor-to-floor time of 60 sec.—32 sec. machine cycle-time, plus 28 sec. for initial and final tying. With manual methods previously employed, a total of 200 sec. was required per stator.

After they have been wound and laced, the stator coils are varnish impregnated, and with the Mark II stators, it is necessary to avoid contamination of the outer surfaces of the shells with varnish, since they are subsequently painted. Impregnation is therefore carried out by the method shown in Fig. 4. Each stator assembly is placed on a thin-walled cylindrical sleeve, into which is fed a supply of varnish. By means of a stopcock associated with each sleeve, the supply of varnish is regulated so that it overflows

slowly from the top of the sleeve, to run smoothly down the sides in a thin, even layer. It then passes through the windings and ventilating holes in the work, without spilling on to the outside of the shell. Varnish draining from the bottom of the work falls into a tank below, whence it is recirculated.

The sleeves are arranged in two banks of 12 each, which are located on either side of the loading station of an associated hot-air drying oven. This oven, which was supplied by Controlled Heat & Air, Ltd., and designed for continuous operation, is equipped with a conveyor comprising a series of horizontal bars carried on driven endless chains. Once the stator coils have been thoroughly saturated with varnish, the supply to the sleeves is cut off, and the stator assemblies are loaded, four at a time, on to the conveyor. The latter carries them slowly upwards into the heating chamber, in which the temperature is maintained at 350 deg. to 375 deg. F. After passing through this chamber, the stators are returned to floor-level. The duration of the heating cycle is 140 min.

BORE SIZING

After the impregnation treatment described, the bores of the stator assemblies are wire brushed to remove surplus varnish, and the shells are cleaned, spray painted, and stoved. Next, the bores are sized with a roll burnishing tool, on an Archdale column drill, at the set-up shown in Fig. 5. A simple fixture, mounted on a slide to



Fig. 5. The bores of the Mark II stators are sized in 12 sec. each, with a 5-roller tool, at this set-up on an Archdale column drill

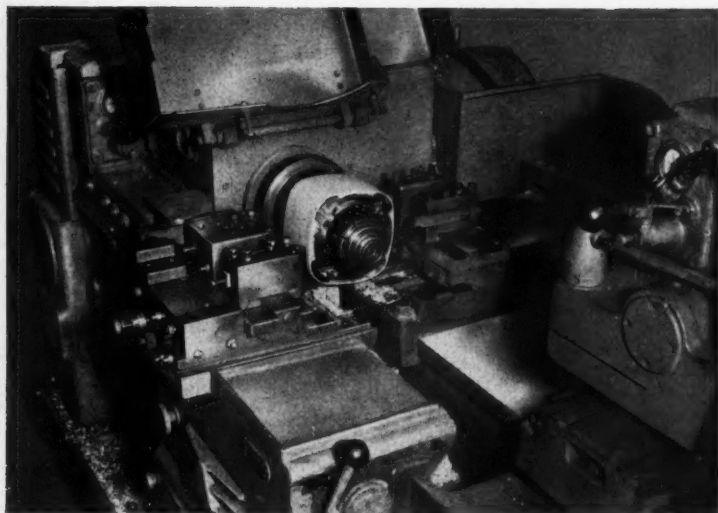


Fig. 6. At this set-up on a Drummond Maximinor multi-tool lathe both end-frame spigots of the Mark II stators are machined simultaneously in 35 sec.

facilitate loading, is recessed on the upper face, to locate the work by an end-frame spigot and shoulder face. The tool, which has 5 rollers, is run at 445 r.p.m., and is fed into the work by hand. Initially, the tool is an easy fit in the bore. When the collar *L*, which is free to rotate on the body of the tool, engages the top of the work, and feed is continued, the rollers are displaced radially by a tapered internal member, to a predetermined overall diameter. The bore of a typical stator is thus sized to 3.635 in./3.640 in. diameter, in a floor-to-floor time of 12 sec.

Subsequently, the end-frame spigots and shoulders of the Mark II stators are machined on the Drummond Maximinor multi-tool lathe shown in Fig. 6. The work is held by the main bore on an air-operated expanding mandrel with a Meehanite body. On the rear slide are mounted two form tools, and on the front slide, two turning and facing tools, all of which are carbide-tipped. When the automatic cycle is started, the work is run at 1,000 r.p.m., and the slides are advanced together, with the rear slide leading. The two rear tools rough machine the spigot diameters and shoulder faces, and initially, the two front tools are positioned beyond the ends of the spigots.

Next, the front slide is fed to the left, so that the right-hand tool finish-machines the spigot diameter at that end, and the left-hand tool is meanwhile traversed to the right, to perform the corre-

sponding operation at the opposite end. At the end of this stage, the rear tools are withdrawn rapidly, and the front tools slowly, to finish the shoulder faces to length. The front tools are then returned to the starting position, the machine stops, and the work is unloaded. This operation is completed on each stator in a floor-to-floor time of 35 sec.

UNDERCUTTING COMMUTATORS

Until comparatively recently, small special-purpose machines of the company's design were employed to slot assembled universal motor commutators, to undercut the insulation, in all Hoover factories. On

each machine, an optical projection system was provided, whereby an enlarged image of a portion of the commutator was projected on to the rear of a translucent screen, which was marked with a fine vertical line. The rotor assembly was mounted between centres and indexed manually, to centralize the image of each commutator-slot, in turn, with the line on the screen. At each index position, a hand-lever was rapidly drawn towards the operator and returned, to advance a small slitting cutter of the appropriate width, rotating at high speed, along the slot, and withdraw it. With this equipment, an experienced operator could slot commutators at the rate of some 70 an hour.

Although this method gave good results, there were certain disadvantages. It was, of course, necessary to employ one operator per machine, and since the work required continuous close concentration, it was tedious and tiring. Moreover, because accuracy depended on the operator's judgment, it could be impaired as a result of fatigue. For these reasons, at Cambuslang, and most of the other Hoover factories, the method described has been superseded by the use of E.M.I. electronically controlled, air-operated, fully-automatic machines, of the design shown in Fig. 7.

As may be observed, the commutator end of the rotor-shaft is held in a collet, which is operated by means of the lever seen at the left, and the

opposite end is engaged by a tailstock centre, also actuated by a lever. When the automatic cycle is initiated, the work is indexed to align each slot, in turn, with the $\frac{1}{2}$ -in. diameter 9-tooth carbide cutter M, which is hollow ground, and has an effective width of 0.0280 in./0.0285 in. This cutter is driven at 6,000 r.p.m., through a belt, by a Hoover i.h.p. motor. At each index position, it is rapidly advanced and withdrawn, by an air cylinder, to undercut the insulation. When the work has completed one revolution, the machine stops, and the work is unloaded. The machine seen in Fig. 7 is one of a group of three, all of which are tended by one operator, who is able to slot a total of 153 commutator an hour.

INDEXING SYSTEM

The indexing motion of the E.M.I. machine is based on a special photo-cell system, which automatically "senses" the positions of the slots, and aligns them with the cutter. A light-beam is projected on to the commutator through a narrow slit, which

is vibrated at 50 cycles per sec., and is reflected therefrom on to a photo-cell. This cell is arranged to produce signals that differ in frequency and

phase, according to the reflective properties of the portion of the surface illuminated by the beam. Thus, one type of signal is produced when the light is reflected entirely by the copper, and others are obtained when the light is reflected partly by copper and slot-insulation, and entirely by slot-insulation. The latter material, it will be understood, has a considerably lower reflectivity than the copper.

These discrete signals are fed to the amplifiers of the electronic equipment, and serve to control the rotation of a 2-phase servo-motor that turns the work. This control system is so arranged that the work is automatically turned to a "null" position, with the slot-insulation located centrally in the light-beam. In this position, the slot is in line with the cutter, and on the latest machines of this design, the positional accuracy afforded is within ± 0.002 in., at the surface of the commutator.

Once the workpiece has been aligned in this manner, the system is



Fig. 8. With the aid of this air-operated equipment, the two ball bearings are pressed on to each Mark II rotor shaft, in a floor-to-floor time of 10 sec.

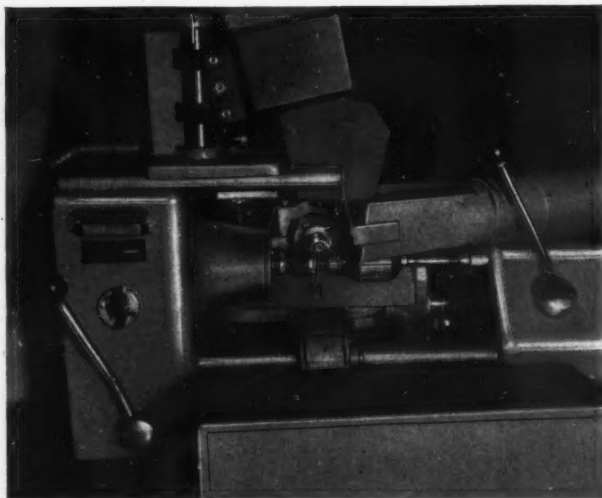


Fig. 7. E.M.I. electronically controlled machines, of the design here shown, are employed for undercutting universal motor commutators automatically



Fig. 9. Typical Mark II motor assembly station, showing one of the pivoted trunnion fixtures used to facilitate handling and access

electrically locked, and the electronic equipment provides the necessary electrical impulses for energizing the pneumatic system, so that the cutter is advanced and withdrawn, and subsequently, for initiating the next indexing motion. A green signal-lamp is also illuminated when the machine stops, on completion of the automatic cycle, to indicate that it is ready for unloading. Controls are provided for setting the machine for commutators with various numbers of slots, from 9 to 100. As may be observed in Fig. 7, air-extraction trunking is arranged close to the cutter and work, to remove as much swarf as possible at the source. The rectangular box seen in the foreground, which is open on the side nearest to the machine, is connected to similar trunking, to remove any falling swarf. These precautions are essential to avoid

clogging of the photo-cell, slit, and other associated items, with the fine particles of copper and insulating material removed by the cutter.

ASSEMBLY OPERATIONS

After the shaft-diameters of the Mark II rotors have been ground, as described in the preceding article, the rotor-laminations are turned to finished diameter. Next, the rotors are statically and dynamically balanced on Gisholt machines, and, where appropriate, the centrifugal switches are assembled to the shafts. A running check is then made to ensure that the switches cut-out at the correct speed. In preparation for final complete assembly of the motors, the various components are placed in metal trays, which are delivered to the assembly stations on a roller conveyor. Each tray contains one set of motor parts, and the conveyor carries the trays past the station shown in Fig. 8, where the ball bearings, for motors so equipped, are pressed on to the shafts. The shaft bearing diameters, it may be noted, are the same for both plain and ball bearing types, but for ball-bearing motors, the shafts are graded into four tolerance categories, for matched assembly of the ball bearings.

The ball bearings, previously packed with grease at an adjoining station, are slid over the ends of the shafts, as seen in Fig. 8, and the work is placed in a semi-circular rest that aligns it with the air-operated, opposed, hollow rams *N*. When the guards seen at right and left are closed, the



Fig. 10. On this 32-station running-in rig, the assembled motors are run-in for 10 min., prior to an aural check in the soundproof booth seen in the background

rams are advanced, and press the bearings home. When the guards are opened, the rams are withdrawn, and the work is transferred to the tray. At this set-up, the two ball bearings are assembled to each shaft in 10 sec.

A typical station in the assembly line is shown in Fig. 9, with one of the pivoted trunnion fixtures used to facilitate handling and access during assembly. As may be observed, trays of small components, such as nuts, screws and washers, are arranged in curved tiers, for ease of access, and power nut- and screw-runners are employed. There are three such stations, at the first of which the terminal end-frame is placed on the spigot of the shell, with the terminal panel in position, and the stator windings are connected to the panel. Here, also, the washers are assembled on the rotor shaft, and one end of the shaft is inserted in the bearing of the end-frame.

At the next station, the second end-frame is assembled, and the remainder of the wiring connections to the terminal panel are completed. The third station provides for assembly of the nameplate, and insertion and tightening of the tie-bolts. The operator at this station, having ascertained that the shaft rotates freely, attaches to each assembled motor, with a rubber band, a record-card that shows the rating, serial number, and other particulars. He then places the motor on a roller conveyor that carries it to the 32-station running-in rig shown in Fig. 10. Here, the motors are connected to current supplies of the appropriate voltage, in batches of 32 at a time, and each batch is run-in for 10 min.

At the end of this period, the motors are disconnected, and carried by another roller conveyor to a soundproof booth, where each is checked aurally, for mechanical defects such as rough bearings or fouling. Following this check, the motors are passed to another section, where they are subjected to a comprehensive series of electrical checks, on rigs of the design shown in Fig. 11. These checks are carried out in accordance with the specification of each motor, and are concerned with: voltage (compliance with rating); starting torque; full-load running torque and wattage; and maximum torque. There is also a flash test, at 2,000 volts for 15 sec., and a megger test.

The motor to be checked is clamped to a sliding base. After the voltage check, in preparation for the torque tests, the motor is slid forward, and the shaft is coupled to an electric dynamometer. Torque is measured by hanging a weight on one of the graduated arms *P*, of the dynamometer body, and adjusting the position until the body is just "floating". The torque, in lb.-in., is then deter-



Fig. 11. Test rigs, of the design here shown, are employed for a comprehensive series of checks on the finished motors. Torque is measured with an electrical dynamometer

mined from the amount of the weight, and the scale-reading. With the equipment described, the entire series of checks is completed on each motor in a floor-to-floor time of 2 min. Finally, at the end of the line, the motors are packed for despatch.

FILAMENT WOUND ROCKET FUEL TANKS. It is reported that the Aero-Space Division of Boeing Airplane Co., U.S.A., are producing experimentally, for the U.S. Air Force, 2-compartment fuel tanks for rockets, of wound glass filament construction. Each tank is of 6 ft. diameter by 21 ft. long, with a capacity of 3,100 gallons, and is designed to withstand a pressure of 665 lb. per sq. in. The filaments are wound on to a pattern and bonded with plastics. Of the two compartments provided in each tank, one holds fuel, and the other the oxidizing chemical.

To prevent attack on the bonding agent, each tank is lined with a blanket made from a specially developed aluminium foil and plastics sheet. As compared with sheet metal tanks, the filament-wound type is lighter and cheaper to construct. The possibilities of producing rocket fuel tanks from metal, ceramic, and quartz filaments are also being examined.

Explosive Forming of Missile Components

By Dr. L. C. STUCKENBRUCK* and C. H. MARTINE*

FOR A NUMBER OF YEARS, explosive forming has been the most promising, and at the same time the most controversial, of the new fabrication techniques. It is only in the past year that this technique has fulfilled early expectations and has been accepted as a standard fabrication procedure. Explosive forming is not the answer to every difficult fabrication problem, nor should it be regarded as a substitute for conventional forming methods. Almost any operation now carried out by such methods could be duplicated by explosive forming, but for most workpieces, conventional methods are cheaper and simpler. The true potential of explosive forming is demonstrated in connection with work that is beyond the capabilities of conventional methods.

In the U.S.A., work carried out by Rocketdyne, Division of North American Aviation, Inc., has indicated two general advantages of explosive forming, namely, low cost and full realization of

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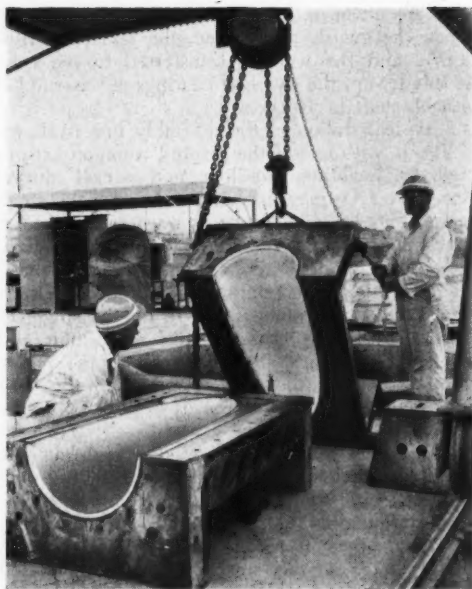


Fig. 1. Two halves of an epoxy-lined die used for sizing a large bullet-shaped pylon cover for a missile by explosive forming

the metallurgical properties of the work material. Die costs can be substantially reduced since only a single male or female die is usually needed, instead of a pair of closely matched dies. This

cost reduction becomes greater as the size and complexity of the formed part increases, and for orthodox forming methods there are definite size limitations, which are being exceeded in current missile designs. Moreover, significant cost savings can be achieved in the production of precision



Fig. 2. Domed-shaped tank end produced by welding together explosive formed sections of SAE 1020 steel

parts, since tolerances can be maintained with relatively inexpensive dies.

Explosive forming allows full advantage to be taken of the physical and metallurgical properties of the work material because correct positioning of the explosive charge or charges of the right size, and strict control of all operational variables, enable spring-back and work-hardening to be reduced to a minimum. In most applications, expensive and time-consuming annealing operations can be eliminated, or at least reduced, and a uniform micro-crystalline structure and hardness can be readily maintained, even when a work-piece is subjected to successive explosive-forming operations. As a result, the physical properties of the work-material, such as elongation and ductility, approach more closely to the optimum values, and many complex shapes have been explosive-formed from unusual and "difficult" materials.

For the most efficient application, explosive forming should be regarded as a new method of fabrication, which can be used in conjunction with other techniques, to extend their range. So far, the size of the part to be formed has not been a limiting factor, and the financial advantages become greater as size increases.

Explosive forming has been found to offer par-



Fig. 3. Manifold section, of about 4 ft. 6 in. diameter, made from René 41 alloy, for incorporation in a rocket engine

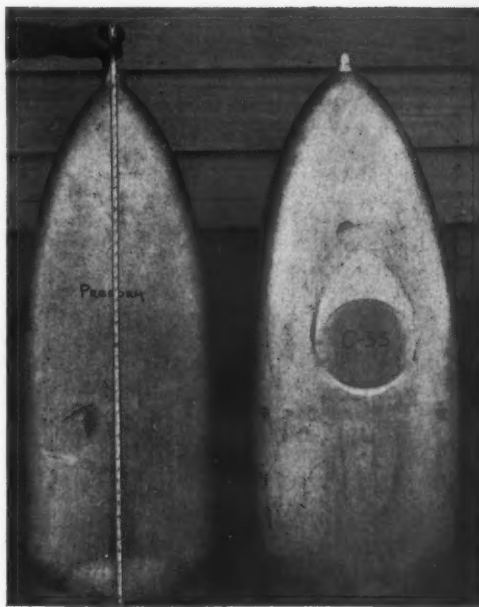


Fig. 4. Aluminium missile pylon cover approximately 4 ft. high, which was sized by explosive in the die seen in Fig. 1

ticular advantages for forming materials with high-temperature strength, low ultimate elongation, and high strength-to-weight ratios, such as are being employed for missile components, and are very difficult to manipulate by other techniques. Frequently, explosive forming has been found to be the only practicable method, and Rocketdyne have successfully formed such metals as aluminium, copper, nickel, tantalum, zirconium, and columbium, also refractory high-strength alloys including 15-7 Mo and 17-7 stainless steels, René 41 and 6-4 titanium.

In the production of a particular component at the Rocketdyne works, individual sections were formed on a drop-hammer, and were then welded to obtain the rough part, which was next brought to size by explosive forming. The part was subsequently heat-treated, to bring it to the required condition, and was finally explosive-formed to remove heat-treatment distortion and to achieve the necessary dimensional accuracy.

Rocketdyne first became interested in explosive forming in 1956, when better methods were sought for forming rocket thrust-chamber cooling tubes. Since that time, a number of investigations con-

cerned with the basic characteristics and applications of the process have been conducted. Although, initially, acceptance of the process was slow, an increasing number of missile parts has been fabricated during the past year, with savings which have often amounted to 50 per cent.

Explosive forming is carried out at the Rocketdyne Propulsion Field Laboratory in the Santa Susana Mountains, near Los Angeles, which is sufficiently isolated to permit relatively large explosive charges to be used. A series of explosion pits, of various diameters, is dispersed about the area, and barriers have been erected so that they can all be operated simultaneously without interference. Structural frames and hoists are provided at the pits to facilitate changing dies and handling workpieces. Metallurgical and die-making facilities are provided nearby.

Extensive research and development were conducted to determine the most satisfactory die materials and designs. For long production runs, steel, Kirksite, and reinforced plastics dies have proved successful, but if only a few parts of simple shape are required, inexpensive concrete dies, lined with plastics, may be used.

Fig. 1 shows a die which consists of two halves



Fig. 5. Structural panels and bulkheads with patterns of stiffening beads can be satisfactorily produced by explosive forming

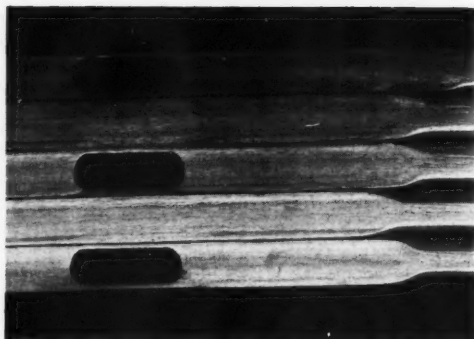


Fig. 6. Tubes of this type are required to have the ends formed to a square section for a rocket application. The ends are formed explosively to close limits

made from Kirksite lined with glass-fibre reinforced, epoxy resin. The die is used to form an aircraft skin section, in the heat-treated condition, and it is designed to permit easy loading of a preform (of cylindrical shape with one closed end) into the cavity. After the preform has been loaded, the die is lowered into one of the water pits, and the subsequent explosion bulges the cylindrical shape to produce a torpedo-like shell. Lubricant, applied to the part prior to forming, facilitates removal from the die.

Most of the dies for complex shapes and heavy materials are made from steel. The experience gained by Rocketdyne indicates that die design is one of the more important factors in successful explosive forming.

The process has been applied to the production of all the major parts of a missile. For example, liquid-propellant missile tanks and solid-propellant motor cases have been formed, either completely or partially. A tank end that has been explosively-formed from SAE 1020 steel is shown in Fig. 2, and similar ends have been produced from stainless steel, aluminium, and titanium, in thicknesses from 0.030 to 0.125 in. The tank end shown is 5 ft. diameter by 3 ft. deep.

Rocket engines incorporate various components, such as manifolds for conducting hot gases, which must be fabricated from high-strength, high-temperature alloys. At the Rocketdyne works, the most widely used of the new refractory materials is René 41 and a manifold section of approximately 4 ft. 6 in. diameter (after trimming) is shown in Fig. 3. The shape of the part necessitated a draw of several inches, which was obtained without annealing, whereas with conven-

tional forming techniques, at least two annealing operations would have been required.

Due to their large size, missile enclosures and skin sections are very suitable for production by explosive forming, and nose cones, radar housings, pylons, and fuselage sections have been formed or sized. Most components of this type are of relatively simple shape, and large sections can be produced to close tolerances by explosive forming.

In some instances, large sections of a fuselage assembly, including punched-out door openings and access apertures, have been formed from single sheets of metal. Typical components have

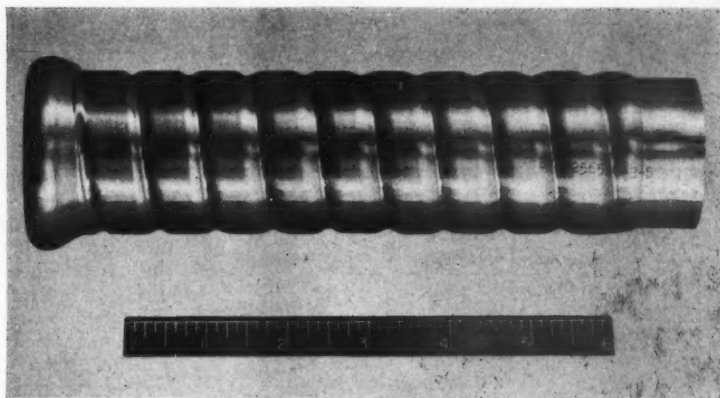


Fig. 8. Rocket-engine thrust chambers have been explosively formed within diameter tolerances as close as 0.002 in. for small, and 0.010 in. for larger sizes

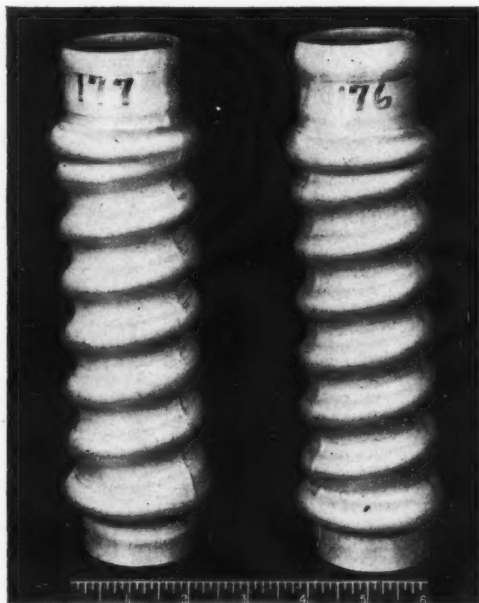


Fig. 7. Complex parts, such as these cooling jackets, have been explosively formed from nickel, 321 stainless steel, Inconel X, 20 CB aluminium, and zirconium

been formed from 2024, 6061, and 7075 aluminium, and from 321, 15-7, and 17-7 stainless steels. In Fig. 4 is shown a 7075 aluminium pylon cover for a missile approximately 4 ft. high. The part was made in two halves, which were drop hammer formed. After the halves had been welded together, the cover was sized by explosive forming, which proved to be the only method whereby the required tolerances could be maintained. This sizing operation was performed in the die seen in Fig. 1.

Missile structural panels and bulkheads with stiffening beads can be satisfactorily produced by explosive forming. The panel shown in Fig. 5 measures 3 by 6 ft. and was formed from PH 15-7 Mo alloy in one operation, in a single Kirksite die. Very little thinning and no warping or wrinkling occurred.

In rockets, extensive use is made of tubing and cooling ducts fabricated from various types of materials, and such components can be readily produced by explosive forming. An unusual application of the technique was to tubes for regeneratively cooled liquid-propellant rocket chambers, the ends of which were required to be square-section, so that they could be successfully brazed. Special explosive charges and fast-operating dies were developed for squaring the tubing, and sizing it to ensure a good fit on the brazing mandrel. The squared ends of typical tubes are shown in Fig. 6, and external corner radii of only 0.0008 in. were consistently obtained.

Complex shapes, such as the cooling jackets in Fig. 7, have also been produced by explosive forming, and materials employed have included



Fig. 9. Mandrel made up of two explosively formed sections for use in assembly operations

nickel, 321 stainless steel, Inconel X, 20 CB aluminium, and zirconium.

Explosive forming of rocket-engine thrust chambers has been extensively investigated and small chambers have been made in considerable quantities, an example being shown in Fig. 8. One of the advantages of the explosive-formed chambers is the consistency with which required tolerances can be held (for example 0.002 in. on the diameter of a small part, and 0.010 in. on a larger size). Very sharp radii can be obtained in the spiral cooling-passage grooves.

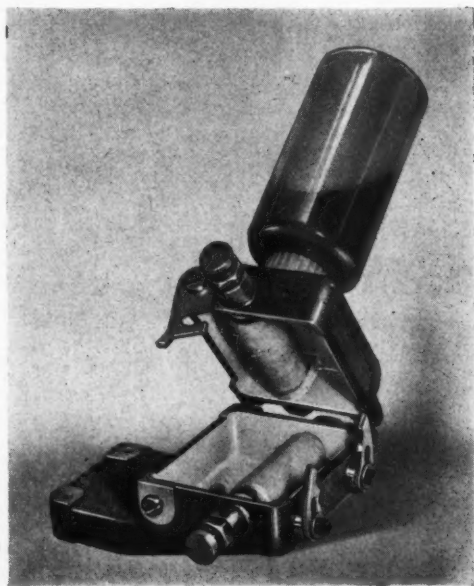
No large thrust chambers have been explosive formed but similar structures have been produced, as shown in Fig. 9. This part is a mandrel that has been explosively formed to close tolerances, and it is used to facilitate assembly of the tubes in a cooled rocket-engine thrust chamber. The part is made in two sections, so that it can be removed after the tubes have been assembled.

Clark Strip Oiling Unit

Clark's Press Equipment, Ltd., Colham Mill Road, West Drayton, Middx., have recently introduced the unit here illustrated, which is primarily intended for lubricating the upper and lower surfaces of strip material before it is fed to a press. With this unit, the oil is supplied to the cores of two felt rollers, for transfer to the material, and is taken through individual needle valves from a bottle, which is detachably mounted, in the inverted position, on the upper section of the unit. With this system, it is claimed, cleanliness in operation is ensured.

The upper section of the unit is pivoted at the rear, as is seen in the figure, and may be swung through 180 deg., to facilitate attachment of the bottle, when full. With the upper section open, the leading edge of a strip may readily be passed through the unit. A latch plate is engaged with a stud on the base, to retain the upper section in the closed position, and rubber strips at the upper and lower edges of a slot at the right-hand side serve to clean the material as it enters.

One size of unit only is available at present, to accommodate coil-fed strip up to 3 in. wide, but it is anticipated that larger units will be introduced in the future.



With this Clark strip oiling unit, lubricant is supplied to the work by way of two felt rollers

Machine Shop Patents

POSITIONING SYSTEM FOR A JIG BORING MACHINE WORK-TABLE

In one system for positioning the table of a jig boring machine, coarse movement is first applied by means of a hydraulic piston, the cylinder for which is attached to the machine bed. The piston is locked in the cylinder after completion of this movement, and final positioning of the table is obtained at a slow rate by rotating a nut, which is threaded on the piston rod and is mounted in bearings on the under-side of the table in which it is prevented from moving axially. With this system, although the final setting movements are short, the application of a series of adjustments in the same direction may cause the nut to become unscrewed from the rod, or jammed at the inner end of the threaded portion. To overcome this drawback, the arrangement shown in the accompanying drawing incorporates provision for warning the operator when the nut is close to either end of the threaded portion, and it can then be re-set to the mid-position.

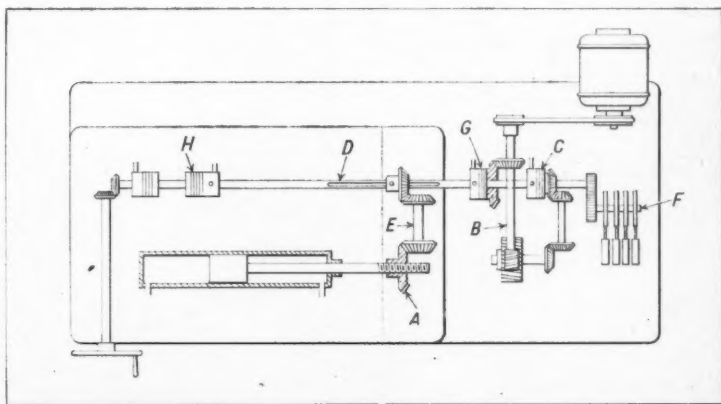
Drive for rotating the nut, which is indicated at A in the accompanying plan view, is taken from a motor through a belt to the cross-shaft B, and thence through worm reduction gearing, two sets of bevel gears, and the electro-magnetic clutch C to the longitudinal shaft D. Motion is transmitted from this shaft through further bevel gearing and the cross-shaft E. All gears in the transmission from the longitudinal shaft are mounted in bearings attached to the under-side of the table.

When the nut is rotated, drive is also taken through spur gearing at the right-hand end of the longitudinal shaft to a camshaft F, and the gear ratio is chosen so that the latter is turned through approximately 270 deg. during the maximum permissible axial movement of the nut. Four cams are

arranged on this shaft, each having an associated switch. In operation, when the nut reaches a pre-determined distance from either end of the permitted travel, one of the cam-operated switches is closed, causing a warning lamp on the machine control panel to be illuminated intermittently. If movement of the nut is continued, a second switch is closed and the lamp is then illuminated continuously.

Re-setting is initiated by means of a push-button, which disengages the clutch C and then engages a similar clutch G. In this way, the cross-shaft B and the longitudinal shaft are directly connected by bevel gearing, to enable the nut to be adjusted at a fast rate. The motor is then started automatically, and runs in a direction which is selected by the closing of one or other of the remaining cam-operated switches. These switches also provide for stopping the motor when the nut has been returned to the mid-position.

The arrangement illustrated also includes provision for finally adjusting the table manually, motion being transmitted to the longitudinal shaft from a hand-wheel through bevel gearing and the electro-magnetic clutch H. This clutch is disengaged automatically when either the hydraulic or motor-driven system is in use, and the adjacent electro-magnetic brake is engaged to lock the hand-wheel.



This arrangement, whereby fine setting of a jig boring machine table is obtained by rotating a captive nut about a threaded rod, incorporates provision for returning the nut to the mid-position of the threaded portion

857,004. Société Genevoise d'Instruments de Physique, 8 rue des Vieux-Grenadiers, Geneva, Switzerland. [Application date in Switzerland, September 10, 1957. Published December 21, 1960.]

MULTI-SPINDLE DRILLING HEAD BUILT FROM STANDARD COMPONENTS

In the accompanying illustration is shown a sectional elevation of part of a special-purpose, multiple drilling head, which is built from a series of standard components.

The principal component that requires to be replaced when a new head is being built up is the plate A, in which there are holes in a pattern corresponding to that required in the workpiece. A sleeve B is assembled in each of these holes, and accommodates a drilling spindle such as C. This sleeve incorporates a lug, which rests on the upper surface of the plate. Clamped in a vertical position in this lug is a shouldered shaft, which carries an idler gear D at the upper end. This gear is in mesh with a pinion keyed to the drilling spindle.

During assembly of the unit, the idler gear shaft of the drilling assembly at the position X is linked, by the bar E, with the central input shaft. In this way, the gear is held in mesh with the pinion F, which is keyed to the input shaft. With this arrangement, the drilling spindle may be set to a

large number of positions, in relation to the centre of the unit. The pinions and the idler gear may be of various sizes, to give the drill speed required. Where drive is taken from more than one position around the periphery of the pinion on the input shaft, the link bar E may be relieved on one face, as shown.

Drive for a further drilling spindle, as shown at position Y, is taken from the pinion on the spindle at X, a link-bar G being provided to maintain the centre distance. In this way, drive may be transmitted successively to a large number of spindles.

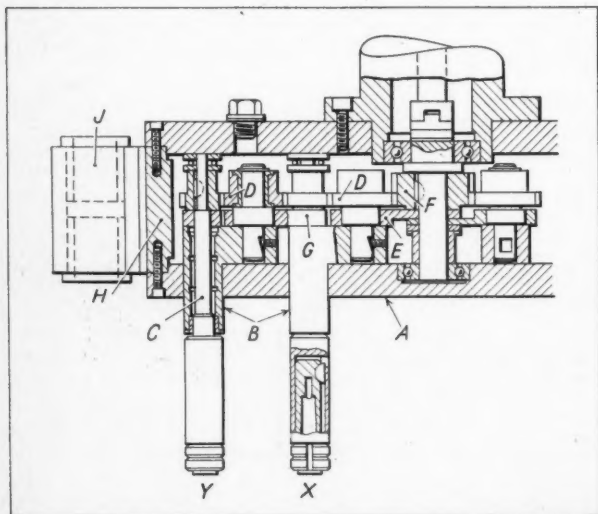
The assembly is surrounded by a ring H which is bolted to the plate A and may be provided with lugs housing guide bushes, as at J. A cover plate, which incorporates an upper bearing for the input shaft, is bolted to this ring, and serves to pre-load ball thrust bearings that are mounted at the upper ends of the drilling spindles.

857,771. S. E. Gill, 264 Holbrooks Lane, Coventry, and G. T. Gardner, 194 Brownhill Green Road, Coventry. [Application date July 11, 1956. Published January 4, 1961.]

BULLOCK RESINOID BONDED DIAMOND WHEELS. For use on a range of hard materials such as tungsten carbide, ceramics, nitralloy, high speed steel, and sapphire, resinoid bonded diamond wheels of various types are marketed by Bullock Research Laboratories, Newent, Glos. Because the diamond section is of a colour different from that of the wheel body, it is possible to see when it has been completely consumed. Technical advice is available to customers and assistance may be given in connection with experiments.

Plain cup wheels can be supplied with diameters from 3 to 8 in.; peripheral wheels from 3 in. by $\frac{1}{8}$ in. thick to 7 in. by $\frac{1}{2}$ in. thick; and taper cup wheels with overall diameters from 2 $\frac{1}{4}$ to 5 in.; also chip-breaker, special peripheral, and optical wheels. For internal grinding there are wheels from $\frac{1}{4}$ to 1 in. diameter, which can be mounted on spindles in accordance with customers' requirements, if required. Metal-bonded grinding wheels in various types and sizes are also available.

EXPORTS OF MACHINERY, other than electric, to Brazil during 1960 reached a total value of £8,027,908, as compared with £3,876,016 in 1959.



Sectional elevation of part of a special-purpose, multiple drilling head, which is built from a series of standard components that can subsequently be re-used

A.E.I. Position Indicating Equipment

POSITION INDICATING EQUIPMENT for use on machine tools has recently been introduced by Associated Electrical Industries, Ltd., Electronic Apparatus Division, New Parks, Leicester, whereby the position of a slide, for example, is shown by a set of dials, which may be located remotely to suit the convenience of the operator and the layout of the machine. A typical panel with two sets of dials—one for the table and the other for the saddle of a machine tool—is seen in Fig. 1. It is claimed that the use of this equipment eliminates the high-degree of concentration required, for example, when readings are obtained from optical measuring systems. Movement of the machine member is detected by a pinion that meshes with a rack, and the angular position of the pinion is relayed to the dials by means of a pair of synchronous-link Magslips, operating on a supply with a frequency of 50 c.p.s.

Since the basic accuracy of the system depends upon the rack, this component must be of high-quality instrument type, and is normally supplied by the machine builder to A.E.I. specification. Drive is transmitted from the rack to a gearbox by a pinion that is split and spring-loaded to eliminate backlash. The gearbox takes the form of a simple bracket-type casting, and the transmitter Magslip and associated gear trains are sealed against the in-

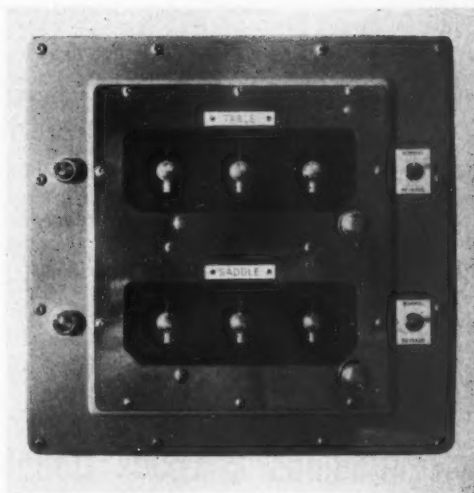


Fig. 1. Panel for the new A.E.I. position indicating equipment for machine tools, whereby movements of a table or other sliding element are shown directly by pointers on dials

gress of dirt and cutting fluids, so that they require very little maintenance.

The connection between the gearbox and the indicator unit is entirely electrical, and the latter unit can be readily incorporated in a pendant panel, or can form a separately mounted unit if preferred.

A receiver Magslip in the indicator unit drives the pointers associated with the 2-in. diameter dials.

There are three dials for each motion to indicate movements of 0.001, 0.1 and 10 in. per calibration, so that the total usable range is from 0.001 to 999 in. Each pointer can be set to a datum position by means of a knob, and to ensure accurate setting, the

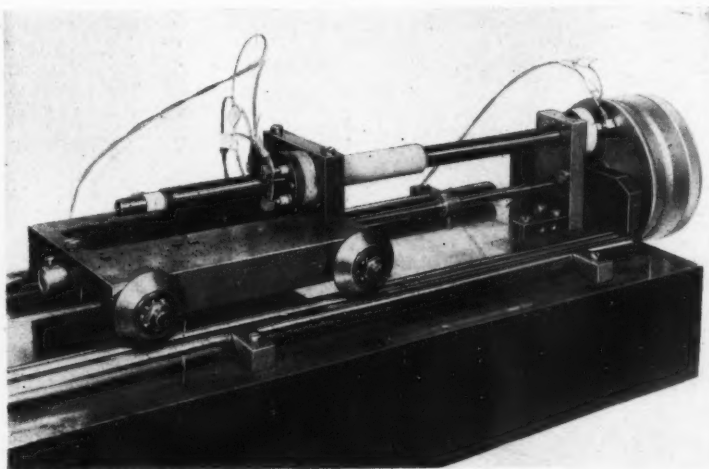


Fig. 2. An experimental set-up incorporating the A.E.I. miniature Helixyn which can control or indicate movement to an accuracy of 0.00004 in.

knobs for the two coarse-reading pointers have "click" location.

A switch is mounted at the side of each row of dials and has "normal" and "reverse" settings. By moving this switch, it is possible to change the direction of rotation of the pointers for a given direction of motion of the associated machine member. Advantage can be taken of this facility when drawings are not prepared in true co-ordinate fashion, so that the dimensions proceed from point to point, and there may be change of direction. The machine operator is not required to make calculations when the direction of the dimensions on the drawing changes, since the appropriate re-setting of the switch allows the pointers to be read in the normal manner, whereas the motion of the machine member is in the reverse direction.

It may also be of interest to mention that A.E.I. have developed a miniature Helixyn, which is similar to the standard type employed for machine tool control systems. This new Helixyn has a bar diameter of approximately 0.5 in., and a cycle length of 0.5 mm. (0.0197 in.). Control or indication of linear positioning to an accuracy of 1 micron (0.00004 in.) can be achieved, as compared with 2.5 micron (0.0001 in.) for standard Helixyns. The new unit will not replace standard Helixyns in machine tool control systems generally, but it will have applications for highly accurate measuring techniques and instruments, such as measuring microscopes, and ultra-precision work performed directly on machines under numerical control. An experimental set-up incorporating the miniature Helixyn is shown in Fig. 2.

Giddings & Lewis Double-table Vertical Boring Mill

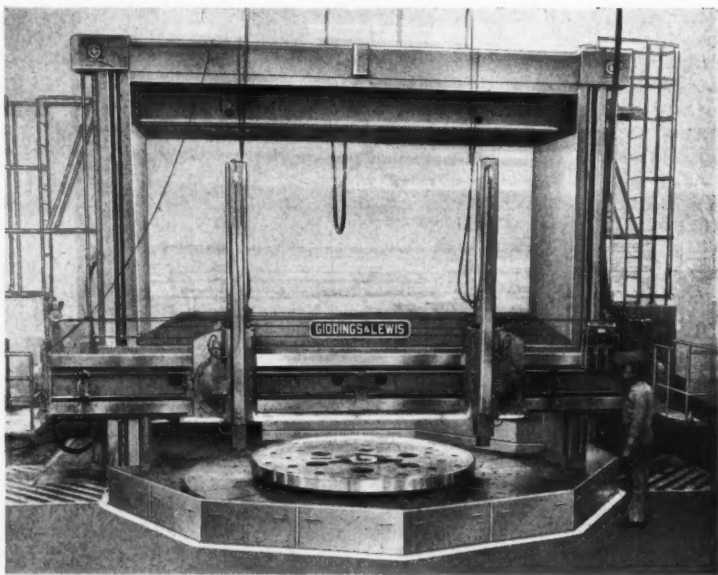
The Giddings & Lewis Machine Tool Co., U.S.A., who are associated with Giddings & Lewis-Fraser, Ltd., Arbroath, Scotland, have built the 20-ft. swing vertical turning and boring mill, here illustrated, for the Verson Allsteel Press Co., Chicago. A feature of this machine is that a 16-ft. diameter table is provided, which can be mounted over a 12-ft. table, for handling large workpieces. When smaller components, requiring higher speeds, are to be machined, the 16-ft. diameter table can be removed.

Loads up to 75 tons can be carried on the table. Vertical thrust is taken by means of a double anti-friction bearing track in conjunction with a Timken pre-loaded taper-roller bearing at the centre, which also serves to carry the radial load. The main drive is provided by a variable-speed motor of 100 h.p., and table speeds from 0.26 to 22.5 r.p.m. are obtainable, in two ranges.

All machine functions are controlled from a

pendant station. In addition, push-button stations are provided at each end of the cross-rail for starting and stopping the table.

Giddings & Lewis machines are sold in this country by The Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2.



Giddings & Lewis vertical turning and boring mill with 16-ft. and 12-ft. diameter tables

NEW PRODUCTION EQUIPMENT

Edited by
G. W. Mason
and
A. J. Barker

David Brown Series 18 Combined Involute and Helix Angle Testing Machines

David Brown Industries, Ltd., Tool Division, Park Works, Huddersfield, have recently added to their range of gear measuring equipment the No. 18 combined involute and helix angle testing machine shown in Fig. 1.

Spur and helical gears with base circle diameters from $\frac{1}{8}$ to 18 in., and diametral pitches from 2 to 28, can be checked on this machine. Gears up to 9 in. diameter, with shafts of 18 in. maximum length, can be held between the work spindle and tailstock centres, and when larger gears are to be handled, the column which carries the tailstock can be removed from the cross-slide. Helix angles up to a maximum of 45 deg. can be checked on gears with face widths up to 4 in., and tooth flanks on spur gears up to 6 in. wide can be inspected for parallelism with the centre line.

A David Brown mechanical-type recording unit is fitted, which has a magnification of 500 \times , and a working range of 0.004 in. Drive to the drum for the paper strip is taken by a pair of friction discs, one of which can be set in different positions with the aid of reference marks on the spindle, to give ratios of graph length to slide movement of 1:1, 2:1, and 3:1. The direction in which movement is to be imparted to the detachable, side-ways-acting, stylus pin, while checking is in progress, can be changed by means of a button on the body of the gauging head.

A No. 18T combined involute and helix angle testing machine is also available, which is of basically similar design and capacity, but is fitted with a Talymin (Taylor, Taylor, & Hobson) electronic rectilinear recording unit. With this equipment, graphs are marked electrically on Teledeltos paper, and the magnification can be varied from 100 \times to 5,000 \times in six steps by means of a switch. A gearbox is incorporated in the unit which gives ratios of graph length to slide movement of 1:1, 2:1, and 4:1. A re-winding mechanism for the paper strip enables several graphs to be prepared side by side. If required, a meter can be provided in place of the recording head. Alternatively, the meter can be connected

electrically to the recording head, but cannot be operated simultaneously with it. When a helical gear is to be checked, the inductance-type, side-ways-acting, gauging head can be swivelled within a sleeve, and accurately set with the aid of a scale, so the direction of movement of the stylus pin is at right-angles to the tooth flank. This feature, it is stated, is of particular advantage when gears with helix angles exceeding 25 deg. are to be inspected.

It is claimed that both machines enable variations in profile shape and helix angle of the order of 0.0001 in. to be recorded. If required, the basic machine can be supplied with a precision dial indicator instead of a recording unit. The indicator

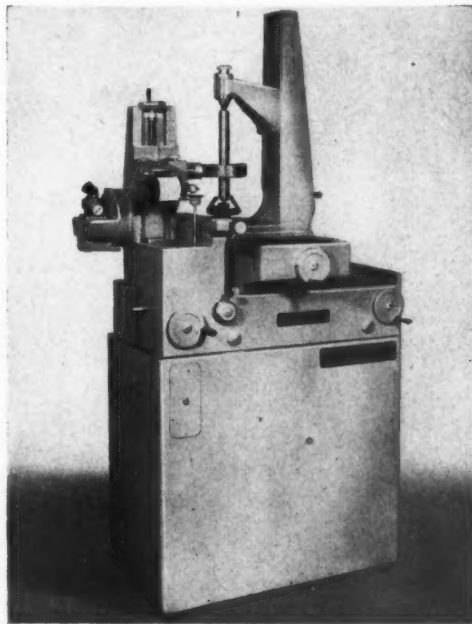


Fig. 1. The new David Brown No. 18 combined involute and helix angle testing machine, fitted with a mechanical-type recorder

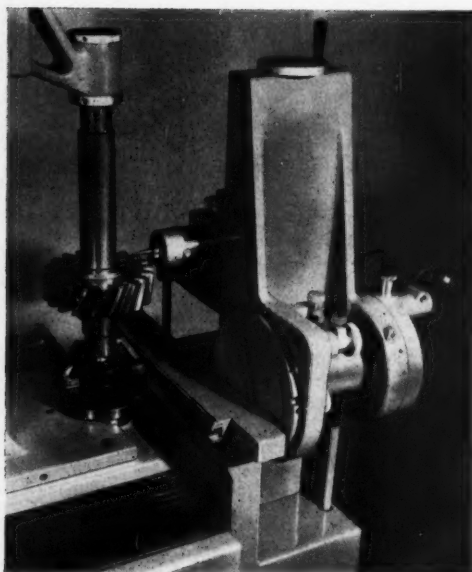


Fig. 2. A close-up view of the David Brown No. 18 machine set up for checking the helix angle of a gear

has a working range of ± 0.002 in., and readings to an accuracy of 0.00005 in. are derived from the stylus pin through a system of levers with a ratio of 1:1. It can be swivelled in the horizontal plane through an angle of about 45° , to permit readings to be obtained from opposing tooth flanks on a gear.

For involute measurement, the machine operates on the individual base-circle disc principle, which ensures positive setting and a high degree of accuracy, and the procedure is as follows. A lever on the front of the bed is turned until a letter "P", on a scale to which it is attached, is brought to the uppermost position, and in this way, the recording unit is connected to the cross-slide. The base-circle disc, mounted on the spindle below the gear, is now brought into engagement with a straight-edge, the contact pressure being controlled by a spring-loaded clutch incorporated in the handwheel-operated mechanism for traversing the guideway base for the cross-slide on the bed-ways. With the gauging point of the stylus pin set directly above the working face of the straight-edge, and in contact with a tooth flank on the gear, the base-circle disc is rolled in contact with the straight-edge by movement applied to the cross-slide by a handwheel. If the flank is a true

involute, a straight-line graph is obtained, but any deviation from the correct form is recorded by displacement of the pen on the chart. In a similar manner, modified tooth forms can be checked and compared with the designed profiles, and scales are provided on the machine to enable positions where departures from the involute forms occur, to be accurately located.

When the gear is to be checked for helix angle, the lever previously mentioned is turned to bring a letter "H" on the scale to the top position. As a result, the recording unit is connected to the column which carries the slide for the gauging head. No movement is imparted to the cross-slide, but the column is traversed in a vertical direction on guideways in the bed by rotation of another handwheel. At the same time, a precision slide, which carries the straight-edge, is traversed in a transverse direction by the action of a block attached to its rear end, which can travel in a slot in the end face of a disc mounted on the column. Since the base-circle disc is held in engagement with the straight-edge, the former is rotated, and the stylus pin is traversed across the face of the gear in contact with a tooth flank. Fig. 2 is a close-up view of the machine set up for performing a helix angle check.

The disc on the column can be turned, and setting of the slot, to suit the helix angle of the gear, can be made to an accuracy of 5 sec. of arc, with the aid of built-in optical measuring equipment. This setting depends upon the diameter of the base-circle disc employed. It follows that, for checking the helix angle, the diameter of this disc need not be the same as the base-circle diameter of the gear. Interchangeable work driver attachments can be supplied for mounting in the spindle bore, and will take gear shafts and mandrels up to $1\frac{1}{2}$ in. diameter, and from 1 to 3 in. diameter. Another attachment is available, which incorporates a $\frac{3}{4}$ -in. diameter work arbor.

Production of the David Brown No. 18R bench-mounted involute tester will continue. Fitted with the company's mechanical-type recording unit, this machine is of similar capacity to the No. 18 and the No. 18T, but differs in design in that the straight-edge and the column for the gauging head are mounted on the cross-slide. No provision is made for checking helix angle, but parallelism of spur gear teeth with the axis can be checked.

Trent Engineering Type TTG I Tap Sharpening Machine

Vaughan Associates, Ltd., 4 Queen Street, Curzon Street, London, W.1, are the sole selling agents for the tap sharpening machine seen in

Fig. 1, which has been designed and built by their manufacturing organization, Trent Engineering Co., Ltd., Wilford Crescent, Nottingham. The machine has been developed for grinding the chamfer lead portions of taps, and it is claimed that no special skill is required to obtain uniform, precision-ground cutting edges. It is pointed out that if the lead angle of a tap is not correctly ground, the tool will not produce accurate threads, and that the life of a tap is greatly prolonged if this angle is ground periodically, before serious wear or damage has taken place.

The machine has a cast bed, which is mounted on a weld-fabricated cabinet-type base. A cross-slide at the left-hand end of the bed supports a wheel-head, that can be swivelled through 45 deg. about a vertical axis, and locked in position by a lever-operated clamp. Drive from a $\frac{1}{2}$ -h.p. resiliently-mounted motor, at the rear of the wheel-head, is taken through a flat belt to the grinding quill. The recessed type abrasive wheel, of 6 in. diameter, is mounted on a



Fig. 1. The type TTG 1 tap sharpening machine which has been developed by Trent Engineering Co., Ltd., Nottingham

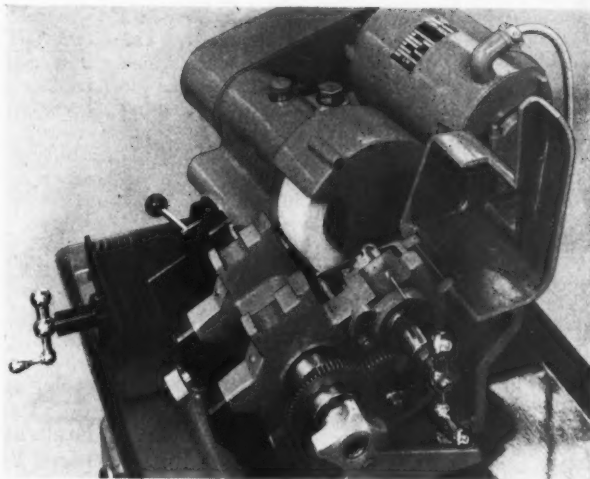


Fig. 2. Close-up view of the tap sharpening machine showing the change gears on the work-head which provide for different numbers of plunge-movements during one revolution of the work

flanged arbor that incorporates provision for balancing. A rack-and-pinion operated, straight-line diamond dressing unit is built into the wheel-head, and the wheel guard has an exhaust duct for connection to an extraction system.

A longitudinal slide at the right-hand end of the bed carries the work-head, and the spindle, which is fitted with a collet-type chuck, can be rotated by means of a hand-crank, through change gears. These gears are enclosed by a hinged cover, as may be seen in Fig. 2, and a range is provided to permit taps with any number of flutes from two to eight to be sharpened. Both the longitudinal slide for the work-head and the cross-slide for the wheel-head are traversed by hand-cranks and screws, and are fully protected by bellows-type covers.

The complete work-head assembly is arranged to rock about a horizontal pivot bar on the longitudinal slide, and is coupled to an adjustable eccentric mechanism. By means of the change gears, it is arranged that during one revolution of the work-spindle, the head is rocked repeatedly to plunge-feed the tap towards the grinding wheel, so that the lead portions are sharpened uniformly. Both left- and right-hand taps can be handled, and the amount of relief can be varied.

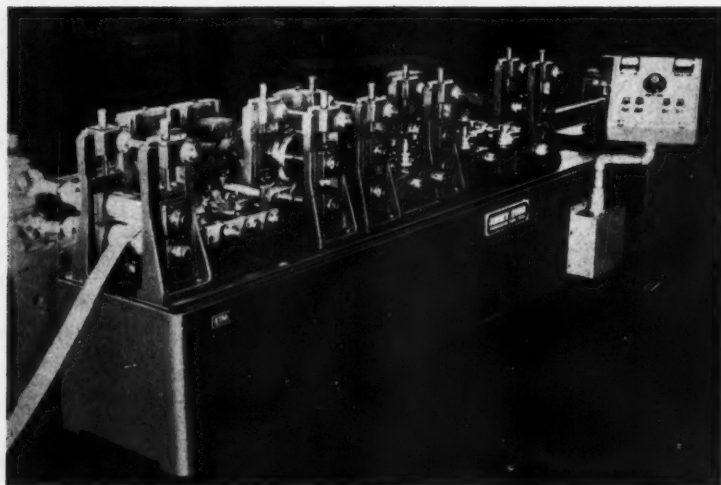
A tap to be sharpened is held in the collet chuck, and is supported by a centre-point, fitted at the end of a bar which is adjustably mounted on the work-head. Taps with shanks larger than

$\frac{1}{2}$ in. diameter, it may be noted, are located in a special bell centre fitted to the work spindle. The wheel-head is set to the required lead angle, which is usually 8 deg. for machine taps. To position the flutes of the tap, there is a swing-away locating unit (not shown in the illustrations). The tap is then rotated by means of the hand crank, and the grinding wheel is advanced by means of the cross-feed screw, the relief on each lead portion being generated automatically.

Taps up to 3 in. diameter can be sharpened at the 8-deg. lead setting, and the distance from collet mouth to wheel may range from 0 to 12 in., with slight variations dependent upon the angular setting. The work-head has a movement of 3 in., and can be adjusted bodily on the associated carriage in increments of $2\frac{1}{2}$ in. for a total distance of 10 in.

Abbey Etna Stainless Steel Tube Mill

The type 2KUS tube mill, here illustrated, was built by the Abbey Etna Co., Perrysburg, Ohio, U.S.A., for whom the British agents are Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11. This machine provides for forming seamed tubing from stainless steel strip, and was designed primarily for tubes of 1-330 in. diameter with a wall thickness of 0-130 in. Diameters from $\frac{1}{2}$ to $2\frac{1}{2}$ in. can, however, be formed from strip of thicknesses from 0-018 and 0-130 in.



This Abbey Etna stainless steel tube mill incorporates only two vertical and two side forming stations

A feature of the machine is that there are only two vertical and two side forming stations, and it is claimed that, with the comparatively small number of rolls employed, the risk of the work being spoiled due to "pick up" on the rolls is reduced. In addition, less time is lost in removing "build-up" from the rolls, and the machine is of a comparatively small size.

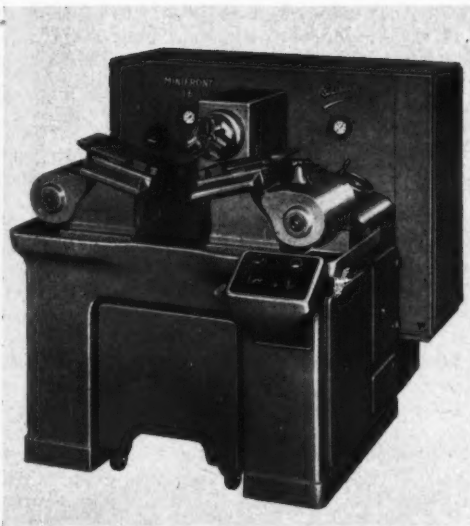
Setting up is facilitated by the fact that roll adjustment at each station is made from one side, motion being transmitted through worm gearing. The principal controls are mounted in a unit which is carried on a swivel arm and can be swung horizontally through 180 deg. It can thus be positioned so that it is accessible for the operator while he is observing any stage of the forming operation.

Minifront 16 Cam-operated Front Turning Lathe

The Minifront 16 cam-operated front turning lathe introduced by J. G. Weisser Söhne, St. Georgen, Schwarzwald, Germany, is available as a single-spindle machine as shown in the figure, or with two spindles.

Developed from the company's Frontor 35 hydraulically-operated front turning lathe, the new machine is automatic, and is intended for operations on fairly short workpieces. Hydraulic copying attachments can be provided for mounting on one or both tool slides, and automatic work handling equipment is available, which, on the 2-spindle machine, enables workpiece blanks to be loaded in readiness for the first operation, and partly-machined components to be transferred from one spindle to the other, for a second operation.

A maximum diameter of $6\frac{5}{8}$ in. can be swung over the cross-slides, and 10 in. over the longitudinal slides, and the ball-bearing mounted headstock spindle is bored $1\frac{1}{2}$ in. diameter. Drive is normally taken from a 5½-h.p. motor, but a 7½-h.p. motor can be supplied if required, and the spindle speeds obtainable range from



Minifront 16, single-spindle type, cam-operated front turning lathes

200 to 4,000 r.p.m. Chucks designed for electric, hydraulic, or compressed air operation, can be fitted.

The tool saddles have a longitudinal travel of $3\frac{1}{2}$ in. on hardened steel bed-ways which are automatically lubricated. Sliding and surfacing motions are derived from separate cams, through levers fitted with follower rollers, and the working travels of the slides are controlled positively by means of stops. Drive to the cams is transmitted by change gears, and the cutting feeds obtainable range from 0.002 to 0.01 in. per rev. The cams for controlling the longitudinal and cross movements are arranged in pairs, and can be readily removed from the machine and replaced by others when the set-up is to be changed.

Sykes Machine Tool Co., Ltd., The Hythe, Staines, Middlesex, are the distributors in this country for Minifront 16 front turning lathes.

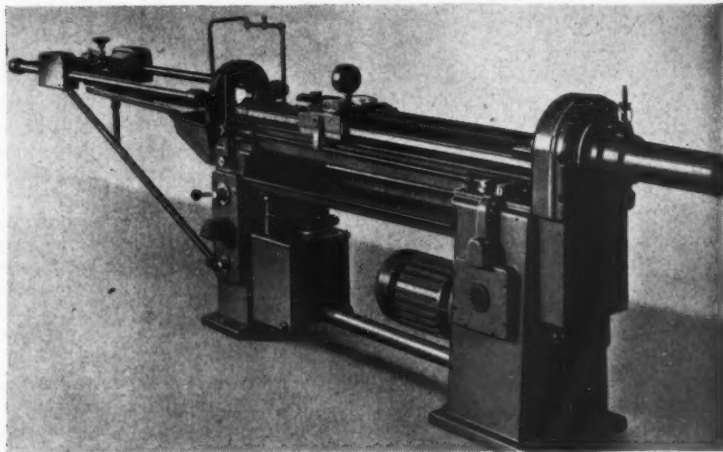
Fleck Horizontal Broaching Machine

Scot Urquhart, Ltd., 373a Earlsfield Road, London, S.W.18, are now marketing in this country the German-built Fleck horizontal broaching machine shown in the accompanying figure, which is available with maximum pull capacities of 5, 7, and 10 tons. Keyways with maximum widths of approximately $\frac{1}{4}$ in. can be cut on the two smaller machines, and up to about $1\frac{1}{4}$ in. on the largest size.

Carried on rectangular-section ways on the steel bed, the broaching slide has a maximum travel of 49 $\frac{1}{2}$ in. It is driven by a 2 $\frac{1}{2}$ -in. diameter, 2-start, buttress-thread screw, through a hydraulic unit. With this arrangement, it is claimed, smooth movement of the slide, without chatter, is obtained. The screw engages a long bronze captive nut, and axial loads are taken by a large ball thrust bearing. Drip-feed oilers are provided for lubrication of the screw.

On the largest machine, which is designated RH 10, drive is taken direct from a flange-mounted, 10-h.p. motor, to a gearbox within the right-hand pedestal, and thence through spur gearing and precision roller chain for the cutting and return strokes, respectively. A dual-type disc clutch is incorporated in the transmission, and the speeds in the two directions are 5 and 13 ft. per min. Adjustable collars may be set on a rod which extends along the bed, and provide for automatically disengaging the drive.

The 10 $\frac{1}{4}$ -in. diameter face-plate is bored $3\frac{3}{4}$ in. diameter. Coolant equipment is normally provided, and the chip tray below the working area



Fleck horizontal broaching machine

can readily be detached, for broaching large-diameter workpieces. An auxiliary slide can be provided, for supporting the trailing end of a long broach, as shown in the illustration. A dividing attachment can be supplied which facilitates the broaching of multiple-splines in parts that are produced in small batch quantities.

The floor space required is 15 ft. 5 in. by 1 ft. 10 in. excluding the area required by the auxiliary slide structure, and the machine weighs approximately 19 cwt.

Droop & Rein Type FPK 140/2 Copy Plano-milling Machine

The type FPK 140/2 plano-milling machine shown in the illustration has recently been added to the range built by Droop & Rein, Bielefeld, Germany, and is particularly intended for profile milling operations on dies for the production of body components for motor cars.

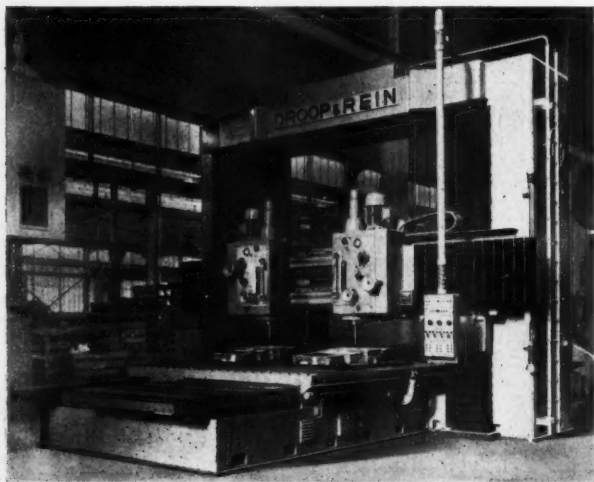
Die blocks with a total weight of 40 tons can be mounted on the 295- by 145-in. work-table, and there are two cutter heads on the cross-rail, which can be arranged for simultaneous profile milling of similar or reverse-image cavities from a single master, under the control of the company's Ecomil copying equipment. Copy milling can be carried out for lengths up to 137 in., and for a maximum width of 59 in. on each of two components. Alternatively, copy milling can be carried out by the right-hand cutter head only, and the maximum width that can then be machined is 86 in. Workpieces

with a maximum height of 79 in. can be handled, and the distance between the columns is 165 in. Maximum and minimum distances of 139 and 21½ in. are obtainable between the centre lines of the milling spindles.

Secured to a bracket at the rear of the cross-rail, the tracer head for the copying equipment has adjustments of 23½ in. transversely, 47 in. longitudinally, and 16½ in. vertically. Fine adjustment for a distance of 4 in. is provided in the longitudinal direction, and the maximum distance obtainable between the centre lines of the tracer head and the milling spindles is 138 in. A patented system is incorporated, whereby the stops for reversing the profile milling travel are automatically adjusted in accordance with the plan shape of the work cavity, so that idle travel is eliminated. Closed-circuit television equipment can be provided, if desired, which enables the point of contact between the tracer head and the master to be observed from the operating position. The machine can be operated without the copying equipment for conventional plano-milling work.

Steplessly-variable feeds from ¼ to 31½ in. per min., also rapid power traverse for the work-table in the longitudinal direction, the milling heads transversely, and the cross-rail vertically, are provided by separated d.c. motors, supplied from a Ward-Leonard set. Table feeds are derived from a 10-h.p. motor, and rapid power traverse from a 19-h.p. motor. Feed and rapid traverse drives for the cross-rail are taken from a 10-h.p. motor, and for the milling heads, from a 7½-h.p. motor. Rapid power traverse for the table and the milling heads is at the rate of 185 in. per min., and for the cross-rail, at 157 in. per min. The cross-rail is traversed on the column ways by screws and re-circulating ball nuts, which ensure sensitive movements, and the maximum distance obtainable between the top surface of the table and the lower ends of the milling heads is 90 in.

Drive to each milling head is taken from a 25-h.p. motor, and 18 spindle speeds from 24 to 1,200 r.p.m. are obtainable. The spindle may be bored to take a No. 50 or a No. 60 steep taper shank, and has an axial travel of 15½ in. The various motions of the machine are controlled by push-buttons and switches mounted on a pendant-type panel, which can be swivelled through an arc of 270 deg., and traversed by an electric drive, on the beam spanning the columns.

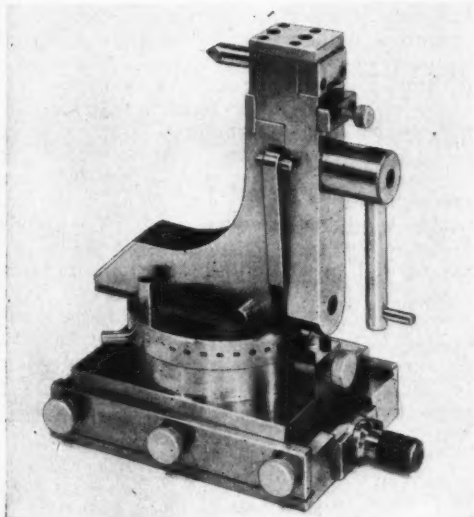


Droop & Rein type FPK 140/2 copy plano-milling machine

Elgar Machine Tool Co., Ltd., 172-178 Victoria Road, London, W.3, are the distributors in this country for Droop & Rein copying machines.

J. & S. Fluidmotion Wheel Dressers

Lorant Engineers (London), Ltd., 65 High Street, South Norwood, London, S.E.25, have been appointed distributors in this country for the



J. & S. Fluidmotion type R.E.C. grinding wheel dresser

range of products made by the J. & S. Tool Co., Inc., Livingston, New Jersey, U.S.A. These products include the Fluidmotion range of grinding wheel dressers, which enable two angles tangent to a radius to be produced in one continuous motion.

An example from this range, known as the type R.E.C., is shown in the accompanying illustration. It has a capacity for dressing concave and convex radii up to 3 in., and the angular travel is $2\frac{1}{4}$ in. Datum buttons enable the required radius to be rapidly set with the aid of a micrometer. Wheels up to 14 in. diameter can be dressed with the unit shown, and others in the range have capacities up to 24 in. diameter. The swivelling member is mounted in sealed, stainless steel, ball bearings, and the sliding members are of alloy steel, hardened, ground, and lapped. An extension diamond holder is available which permits wheels up to

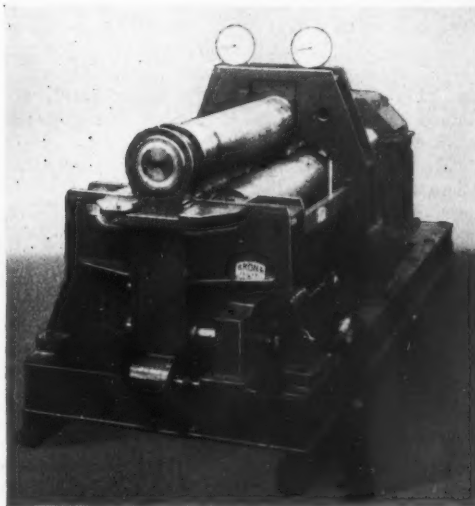
19 in. diameter to be dressed, and there is also an attachment for dressing 180-deg. concave radii.

Bronx 3-roll Pinch-pyramid Type Plate Bending Rolls

The figure shows pinch-pyramid type plate bending rolls built by Bronx Engineering Co., Ltd., Lye, nr. Stourbridge. This heavy-duty machine has a pre-bending capacity of 8-ft. wide by 2-in. thick mild steel plate, and a rolling capacity of 8-ft. by $2\frac{1}{2}$ -in. mild steel plate. The rolls are arranged in pyramid form, but instead of the top idle roll being provided with vertical adjustment, the two bottom, driven, rolls are adjustable, and they can be moved in the vertical direction, either independently or simultaneously.

A main motor of 120 h.p. is employed, and there are two 40-h.p. motors for the independent adjustment of the bottom rollers. All the motor controls are grouped together on a desk. For the removal of a completed cylinder, the top roll is balanced, and the swing-down housing is lowered by a $7\frac{1}{2}$ -h.p. motor which is also controlled from the operator's desk.

With the pinch-pyramid design, plates can be rolled in the same manner as on a normal 3-roll pyramid type of machine. In addition, both long edges of a plate can be pre-formed prior to rolling, without removing the plate from the machine between operations.



Bronx 3-roll pinch-pyramid type plate bending rolls

Machine for Feeding and Inserting Dowel Pins

THE MACHINE SHOWN in the accompanying illustration has been developed by Rhoden Partners, Ltd., 19 Fitzroy Square, London, W.1, and provides for automatically delivering and inserting two dowel pins simultaneously. Intended for repetition work, the machine can be readily adapted to handle pins of many different types, and to feed and insert various numbers of pins at one time.

Top and bottom bolsters, indicated at A and B, respectively, are connected by rigid pillars. An impact-type air cylinder C is mounted on the top bolster, and the piston rod of this cylinder is coupled to a sliding bolster D. Punches (in this instance two) are fitted to the under-side of this sliding bolster, and are mounted in a punch plate, with a hardened backing plate, in accordance with normal press-tool practice.

A second sliding bolster E moves on the guide pillars, and is fitted with a block which acts as a work-clamping member, and is also provided with guide holes, which are a sliding fit for the punches. Two cylindrical rods, as shown at F, connect the sliding bolster E rigidly to a cross-head G. This latter member is secured to an air cylinder H, the piston rod of which passes through a hole in the cross-head and is secured to the platform L of the machine, which supports the bolster B and the other members of the assembly. Holes in the bolster B are a sliding fit for the rods F, and there are clearance holes for the rods in the machine platform. By directing compressed air to one end or the other of the cylinder H, the sliding bolster E is moved up or down, to engage or disengage the work clamping member.

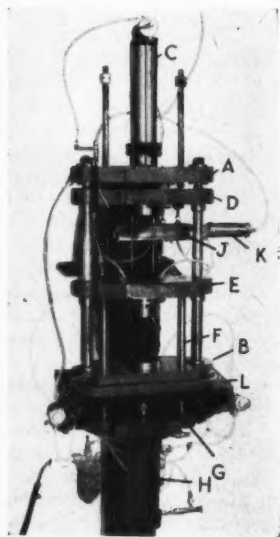
On the stationary bolster B is mounted an adapter for locating the work. If the dowel holes pass through the component, these holes can be conveniently employed for location purposes, spring-loaded pilot pins being provided, which are depressed by the dowel pins, as the latter are thrust into the holes.

Dowel pins, in bulk, are loaded into a Syntro vibratory bowl feeder, at the rear of the machine, which is arranged to sort, orientate and deliver pins by way of two outlet channels. From the outlets, the pins are fed through short flexible tubes to an escapement mechanism J. This mechanism is actuated by an air cylinder K, and incorporates a sliding shuttle whereby the lowermost pin in each tube is transferred to a position above one of two flexible tubes leading to the work-clamping member secured to the under-side of the sliding

bolster E. The pins are moved rapidly along these tubes by blasts of compressed air.

The machine is arranged for bi-manual operation to ensure that the operator's hands are clear of the working zone. After a component, or group of components if several are to be dowelled together, has been loaded on to the pilot pins that project upwards from the adapter on the bolster B, a push-button at each side of the machine is depressed to initiate the automatic cycle. Air is then admitted to the lower end of the cylinder H, with the result that the lower sliding bolster E is moved downwards to clamp the work. At the end of this movement, a pneumatic valve at the right-hand side of the machine (not clearly visible in the illustration) is operated, to direct air to the cylinder K of the escapement mechanism. Two dowel pins are delivered by way of the flexible tubes and come to rest on the spring-loaded pilot pins that project above the work. Air is next directed to the impact cylinder C, and the upper sliding bolster D is thus thrust rapidly downwards, and the punches secured to this bolster force the dowels into the work.

At the end of its downward travel, the piston of the impact cylinder is immediately returned, and, simultaneously, the air supply to the cylinder H is reversed. In consequence, the punches and upper clamping member rise clear of the work at the same time, in readiness for unloading. The automatic stages of the machine cycle occupy about 2½ sec., and the overall floor-to-floor time depends on the number of components to be loaded, and the operator's skill.



Air-operated machine designed and built by Rhoden Partners, Ltd., for feeding and inserting dowel pins

The Precise Measurement of Small Objects*

By J. DYSON, Sc.D., F.Inst.P.†

THE IMPORTANCE OF FACILITIES for accurate measurement in engineering production and research activities is fully appreciated, and, in general, adequate equipment and procedures are available for measuring objects of a size that can be manipulated by hand. A rapidly increasing range of products is appearing, however, which incorporates components that are inconveniently small to be measured by existing methods and equipment, and such components are required, for instance, for lamps, electronic devices, and various delicate mechanisms.

A typical problem is the measurement of ultra-fine tungsten wire, of the order of 0.001 in. diameter, and it was for work in connection with this material that the instrument here described was developed. During the course of research on lamps it was required to ascertain if "necking" was present in short lengths of the tungsten wire, and it was necessary to compare the diameters at various points along the length of the wire to an accuracy within 1 per cent.

Such accuracy is beyond the capabilities of conventional micrometers, and in any case the use of such an instrument in the normal manner would probably result in slight crushing of the wire, and consequent falsification of the readings. Moreover, any "necks" in the wire could easily be bridged by the contact faces of the micrometer, and would thus escape detection. It was decided, therefore, that an optical system of measurement should be investigated, since use could then be made of magnifying techniques and contact with the specimen would be avoided.

Two obvious optical methods were the use of a projection microscope, with measurement of the projected image by means of a scale, and of a conventional microscope, with provision for measuring the image by an eye-piece scale or a travelling wire eye-piece micrometer. For various reasons, however, both these systems are inadequate. With a projection

microscope, the image is usually not "sharp" enough to permit the required accuracy of measurement. Both the eye-piece scale and the travelling-wire systems suffer from the disadvantage that coincidence has to be obtained between the edge of the image (which is somewhat diffuse, and of low contrast) and the scale division in the eye-piece, or the travelling wire, each of which is sharply defined and of high contrast.

Settings are therefore difficult to make to the required degree of accuracy, and entail great concentration, which rapidly results in fatigue. Furthermore, no microscope is completely rigid, and any contact with the instrument—to operate the travelling-wire micrometer, for example—may cause relative motion between the image and the wire which is in excess of the maximum allowable error of measurement.

THE PRINCIPLE OF IMAGE SPLITTING

The instrument which was subsequently developed overcomes the difficulties mentioned above, and is based on a long-established principle known as image-splitting. Two separate images of the object to be measured are formed in the same field of view, and means are provided for moving (or "shearing") the two images across each other. A scale is provided by which the amount

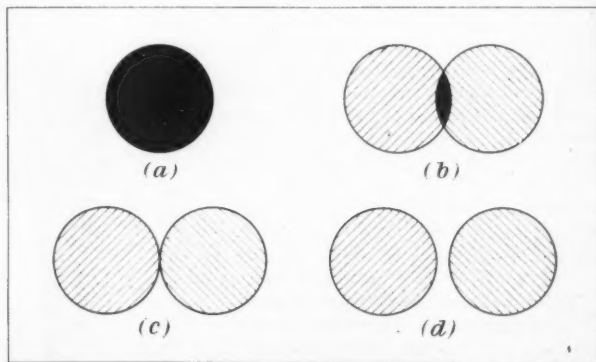


Fig. 1. Diagrams showing typical coincident and split images as seen in the eye-piece

* Abstracted from a recent issue of AEI Engineering, published by Associated Electrical Industries, Ltd., 33 Grosvenor Place, London, S.W.1.

† AEI Research Laboratory, Aldermaston.

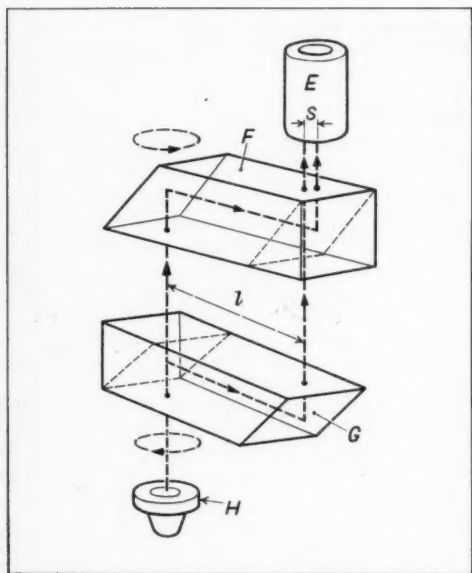


Fig. 2. The optical system of the image-splitting eye-piece employed in the measuring equipment is here shown diagrammatically

of movement, or shear, can be read. The procedure can best be explained by reference to Fig. 1, where the specimen to be measured is in the form of a small opaque disc. With no shear, the two images coincide, to provide a black disc as shown at *a*. As shear is applied, two images appear as grey discs, and any overlap between the two images is seen as a black region, as at *b*. When the amount of shear applied is equal to the diameter of the specimen, the two grey images touch (as at *c*), and if further shear is applied the two images separate, leaving a white gap as at *d*.

Fig. 3. These two views show (left) the complete image-splitting eye-piece attachment, and (right) the attachment with the side covers removed to disclose the prisms and the micrometer adjustment for setting the required amount of "shear"

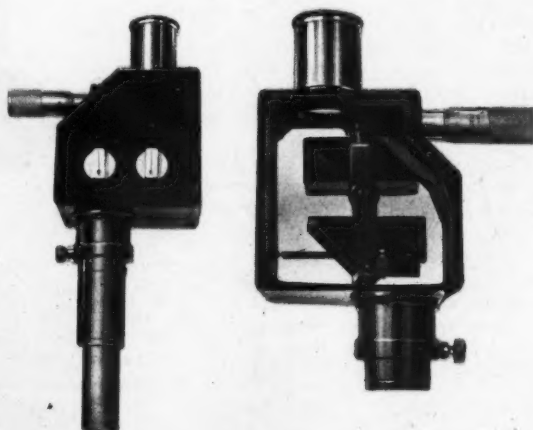
The edge-to-edge setting, as shown at *c*, can be made with great precision, since the transition from a dark region to a light region is very sharp, and the operation is further facilitated by the fact that the two images are of identical appearance, sharpness, and contrast. If the instrument is accidentally disturbed, the two images move bodily, and there is no adverse effect as regards the accuracy of measurement. It has, in fact, been found that a setting can be made on a slowly-moving object without loss of accuracy.

In operation, the setting shown at *c* in Fig. 1 is made, and a reading of the amount of shear applied is taken from the associated scale. Next, the direction of shear is reversed. In other words, the images are crossed so that the opposite edges are aligned. When the edge-to-edge setting has been repeated, another reading is taken from the scale, and the difference between the first and second readings is proportional to the diameter of the specimen. The constant of proportionality can readily be obtained by calibration on an object of known diameter, or by use of a glass slide engraved with very fine lines of accurate spacing, which is obtainable from a microscope maker.

If a number of similar objects is to be measured, for example, for inspection purposes, it has been found that if the reading for zero shear is known it is necessary to make only one setting for each specimen.

THE IMAGE-SPLITTING EYE-PIECE

The optical system is shown in diagrammatic form in Fig. 2, the eye-piece being indicated at



E. Below the eye-piece there are two prisms, as at *F* and *G*, each comprising a rhomboidal and a right-angled triangular prism, cemented together. The interface of each prism is lightly metallized, in order to provide a partially-reflective surface. A ray from the objective lens *H* is split into two parts at the partially-reflective surface of the prism *G*, one part continuing and the other being traversed laterally through a distance *l* before being directed vertically upwards to the eye-piece. The continuing ray from the prism *G* is also traversed laterally by the prism *F*, through a distance *l*, and is subsequently directed vertically upwards to the eye-piece.

If the generating lines of the prisms *F* and *G* are parallel, then the vertically emerging rays will coincide, and one image only will be seen in the eye-piece. The two prisms, however, are arranged to swivel, about a common vertical axis, and are shown set out of alignment in Fig. 2. With this arrangement, the two vertical rays emerge from the prism *F* displaced by an amount proportional to the angular misalignment, with the result that the two images are "sheared". If one prism is swivelled through an angle θ from the parallel position, the distance *S* between the emerging rays is given by the expression:—

$$S = 2l \sin \theta/2 \dots\dots\dots (1)$$

If one prism only is swivelled, however, it will be found that there will be a change in direction of a line joining two corresponding points on the two images, and this effect may be undesirable. It is arranged, therefore, that the two prism blocks are constrained to swivel by equal amounts, and in opposite directions, by the provision of a simple linkage system. The images then drift slightly in a direction normal to the line of shear, but since the amount of drift is very small it is generally of no significance. Rotation of the prisms is effected by means of a micrometer head, the spindle of which abuts a small bearing ball mounted on an arm which is attached to one of the prism blocks. The plane containing the axis of rotation and the centre of the ball is arranged to be normal to the axis of the micrometer when the "shear" is zero. With this arrangement, the amount of shear *S* is exactly proportional to the travel of the micrometer spindle, so that an accurately linear scale is provided.

The incorporation of the two prisms in an existing microscope increases the tube length of the latter, and may therefore affect the correction of the objective lens. This difficulty is overcome by the addition of two lenses, beneath the prism *G*, but not shown in Fig. 2. In some applications it might be difficult to determine to which image

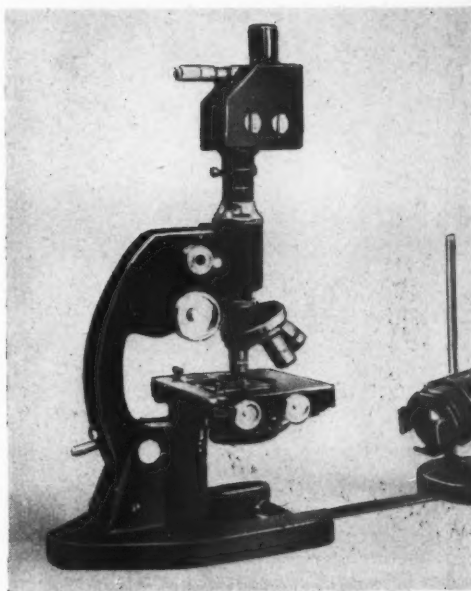


Fig. 4. The image-splitting eye-piece is here seen fitted to a bench-type microscope

a particular detail belongs, but such identification problems are overcome by the provision of red and green filters. These filters can be inserted, as required, between the two prisms, to colour one image red and the other green.

Two views of the image-splitting eye-piece which is built under licence by Cooke, Troughton & Simms, Ltd., Haxby Road, York, are shown in Fig. 3. The complete unit is seen at the left, and the two white knobs provide for introducing and withdrawing the coloured filters mentioned above. At the right, the unit is shown with both side covers removed, to reveal the two prisms, the micrometer spindle, and the bearing ball whereby the swivelling movement is transmitted. A view of the complete attachment fitted to a bench-type microscope is given in Fig. 4. The unit can be applied to almost any type of bench microscope which has a body tube with sufficient unobstructed length to accommodate the corrector lenses, that is, to almost any monocular instrument without an inclined eye-piece. Measurement in different directions can be made by turning the attachment relative to the body tube.

It is known that the distance *d* between two points which can just be resolved under a microscope is given by the expression:—

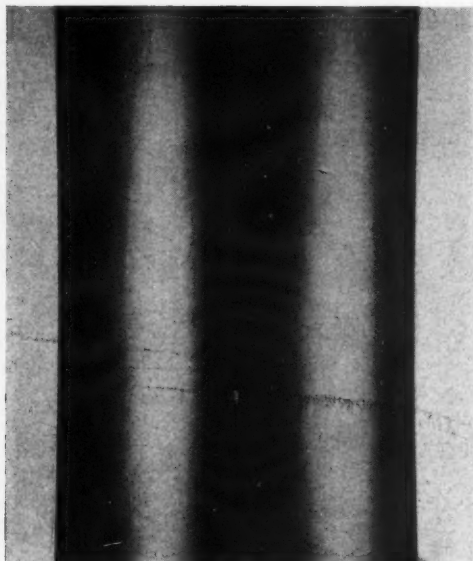


Fig. 5. The sharpness of transition from overlap to separation is here demonstrated by the split image of a 0.008 in. diameter, tapered, glass fibre

$$d = 0.61 \lambda / (N.A.) \dots\dots\dots (2)$$

where λ = the wave-length of the light used and $N.A.$ = the numerical aperture of the objective lens. Although it might reasonably be supposed that the accuracy of setting of the image-splitting eye-piece would be approximately equal to the resolution limit d , it has been found that it is considerably in excess of that value. This improvement is explained by the fact that the intensity at the mid-point changes very rapidly with the separation of the two images. Theoretical investigations¹ of this point suggest that, under optimum conditions, the error of setting e is given by the expression:—

$$e = 0.058 \lambda / (N.A.) \dots\dots\dots (3)$$

which is approximately ten times smaller than the resolution limit d .

Theoretical analysis has also shown that if the object is thin, and is illuminated by a condenser lens with an aperture as great as that of the objective lens, the object diameter so measured is the true diameter, and is not subject to systematic errors. If the object is of finite thickness, as it must be in practice, a systematic error not greater than the resolution limit d is possible. This error,

however, is of no consequence if the instrument is used for inspection purposes. Systematic errors will also be present if the objective lens has noticeable distortion, but, in general, these errors will be very small if the width of the object is not greater than one third of the field of view.

RESULTS AND APPLICATIONS

As already mentioned, the instrument was first used for measuring the diameters of fine wires, and was fitted with a 4-mm. objective lens of $N.A.$ 0.85. Since the wire is of circular cross-section, difficulty was experienced at first in obtaining a satisfactory image, but a considerable improvement was obtained by laying the wire on a microscope slide, placing a covering glass on top, and filling the surrounding space with xylol. This arrangement reduced the convergence angle of the rays, without introducing any errors, and enabled a sharp image to be obtained.

Using expression (3) under these conditions, and with green light, a setting error of about 1.5 micro-inches is obtained, and this value is about one-sixth of that required when measuring the thinnest wires. In practice, it was found possible to repeat readings to the above degree of accuracy, and in some instances, to improve on it.

An illustration of the transition between overlap and separation is afforded by the split-image of a glass fibre seen in Fig. 5. This fibre is approximately 0.008 in. diameter, and is tapered by slightly less than 0.00008 in. over the length which is shown. The shear setting is such as to provide edge-to-edge alignment at a point close to the centre in the figure, and is obvious that the point of contact can be determined to within a very small fraction of the visible length. As a result, it is apparent that the setting accuracy is considerably better than 0.00008 in. The objective lens employed is 16 mm., $N.A.$ 0.28, which from expression (2) provides a resolving limit of 0.000047 in. The setting accuracy is thus considerably better than the resolving limit would suggest. For reproducible results of the highest accuracy, focusing is critical, but it has been found possible to achieve the required skill after a short period of practice.

An important advantage offered by the instrument is the ability to detect necks in wire without actually performing a measurement. The two images are set in edge-to-edge contact, and the wire is moved longitudinally through the field. Any increase or decrease in the diameter of the wire is immediately apparent by the appearance of a dark or bright line, respectively. Once the presence of a diameter variation has been detected

¹ All references at end of article.

in this manner, a measurement can be made to determine the amount.

The instrument has also been applied for checking the wire helices which are incorporated in travelling wave tubes, and, typically, are made from 0.003-in. diameter wire, wound to 180 t.p.i., and a diameter of 0.040 in. In the manufacture of these helices, it is necessary to restrict errors to less than 1 per cent of the pitch distance. The application of the instrument to the measurement of these components has been described elsewhere,² and a typical image is shown in Fig. 6. The image is sheared so that one side of the space between the turns just contacts the other side, and the helix is then traversed longitudinally. Any pitch error is immediately indicated by the appearance of a bright or dark line, which shows that the images have separated or overlapped. Bright and dark lines are readily visible in Fig. 6, which is indicative of the results obtained when inspecting a helix of poor quality. Once a pitch error has been found, it can be measured by ascertaining the amount of shear required to restore edge-to-edge contact. With this method it is assumed that the diameter of the wire from which the helix is wound is constant. On the other hand, such an assump-

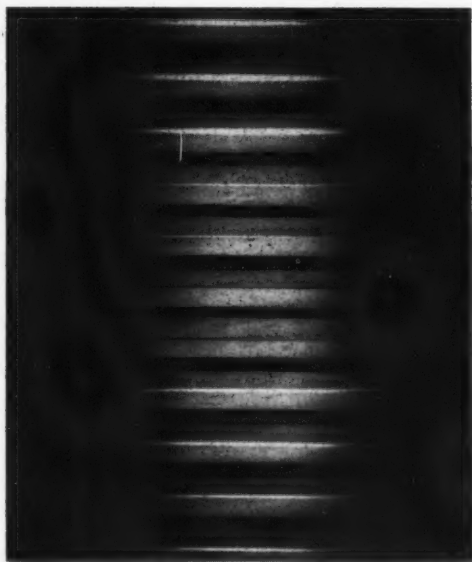


Fig. 6. Split image of a wire helix. Pitch errors are revealed by the bright and dark lines, and the amount of error can be measured by reading the amount of shear which must be applied to restore edge-to-edge contact (magnification $62.5\times$)

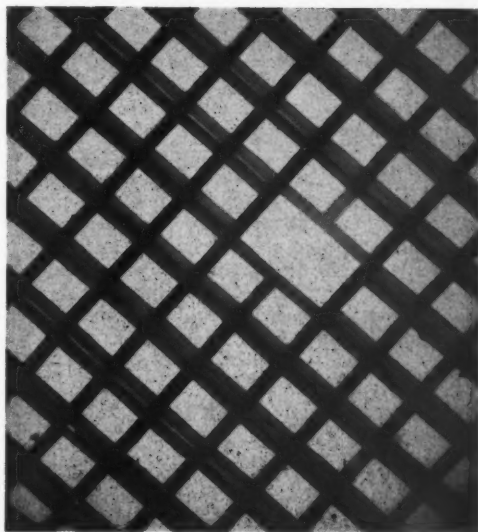


Fig. 7. Errors in this grid for an electron microscope are revealed by the presence of bright and dark lines, representing separation or overlap of the split images (magnification $50\times$)

tion can be avoided if one turn is sheared into coincidence with the next. The setting accuracy with this procedure is a little less than that for the former method, but in practice is found to be adequate. The instrument will also indicate rapidly errors in periodic structures, and a typical application of this kind is shown in Fig. 7. The object here viewed is a grid for an electron microscope, and the shear of the images is equal to the length of the side of one of the square apertures. Errors in uniformity are immediately apparent, as revealed by the presence of dark and bright lines, representing image separation or overlap.

The detection of errors without the need for taking measurements is of particular importance in this connection, and by arranging for a small, but predetermined, amount of shear to be introduced into the setting at will (as can readily be accomplished), the whole process of inspection of a periodic structure could be reduced to a simple "go" and "not go" test.

SUMMARY

The image-splitting eye-piece has been used successfully for measuring errors in, and inspecting, a wide range of specimens, including graticules,

wires, wire helices, Vickers hardness impressions in metal and glass, and red blood cells. One of the most important features of the equipment, apart from the speed with which it can be operated and the accuracy of the results, is the reduction in operator fatigue as compared with that experienced with other types of instruments for performing similar duties. Tests have been carried out to compare the results obtained by different operators when measuring the same object, and it was found that—after a period of a few minutes during which familiarity with the instrument was acquired—readings made by different operators did not differ significantly from successive readings made by the same operator. It is felt that the instrument has

considerable contributions to make in the fields of laboratory and inspection work.

ACKNOWLEDGEMENTS

The author expresses his thanks to Cooke, Troughton & Simms, Ltd., for their co-operation in developing the instrument here described, and for permission to reproduce Fig. 3 and 4, also to Dr. T. E. Allibone, C.B.E., F.R.S., Director of the A.E.I. Research Laboratory, for his permission to publish this article.

¹ *Precise Measurement by Image-splitting*, Dyson J., J. Opt. Soc. Amer. 50, 754, 1960.

² *Optical Methods of Helix Measurement for the VX.4164 Travelling Wave Tube*, AEI Rugby Research Laboratory Report, L4758.

I.C.I. Kutern Copper Alloy

Imperial Chemical Industries, Ltd. (Metals Division), P.O. Box 216, Birmingham, 6, have recently published up-to-date literature relating to the copper alloy known as Kutern, which can be machined at speeds—and with cutting tools and tool settings—similar to those normally used for operations on brass.

As a result of tests that have been carried out, the machinability of this alloy is assessed at 90 per cent of that of free-turning brass. Manufactured under closely-controlled conditions, the alloy comprises pure copper and 0.4 to 0.75 per cent tellurium, and it is stated that the good machinability is due to evenly distributed particles of copper telluride, which is insoluble in copper.

Turning can be carried out at cutting speeds ranging from 200 to 500 ft. per min., or higher, and a good surface finish can be obtained. Cuttings produced when the alloy is turned break up into small chips, which fall away from the tool in a similar manner to those formed when turning brass. Lubricants or cutting fluids should be used for turning Kutern, and carbide-tipped cutting tools are recommended when parts are to be produced in large quantities. It is stated that for drilling, the rate of penetration in Kutern is 90 per cent of that in brass, as compared with only 32 per cent for pure copper. High-speed steel twist drills should be used, and it is recommended that light cutting oil should be employed.

During one test, on a hacksawing machine, a piece was cut from a 1½-in. diameter bar with 36 strokes of the saw blade, whereas 115 strokes were required to cut a piece from a bar of pure copper of similar diameter, with the same cutting pressure.

Hot- and cold-working properties, and resistance to corrosion, of Kutern alloy are similar to those of

MECHANICAL PROPERTIES OF KUTERN COPPER ALLOY

Properties	As extruded	Extruded and annealed for 30 min. at 500 deg. C.	Extruded and cold drawn with 25 per cent reduction in cross-sectional area
Tensile strength (tons per sq. in.)	15	15	20
0.1 per cent proof stress (tons per sq. in.)	3	2.5	17
Limit of proportionality (tons per sq. in.)	2	2	15
Elongation (per cent on 2 in.)	35	50	10
Reduction in area (per cent)	40	40	20
D.P. hardness	53	53	100

pure high-conductivity copper. The softening temperature for the alloy is of the order of 350 to 400 deg. C., depending upon the amount of cold working it has received, whereas high-conductivity copper becomes soft at 250 deg. C. or less.

Mechanical properties of Kutern in the extruded form, and after it has been annealed and cold drawn, are shown in the table.

The alloy can be supplied in the form of round bar and extruded sections, and is particularly intended for the production of parts which are required to have a good-quality surface finish and high electrical and thermal conductivity. Tellurium-copper has been used for the production of certain intricate parts for radar equipment, for which close dimensional tolerances and vacuum-tightness have been specified, and in the aircraft industry for making such components as pins and inserts for multiple-contact assemblies. It is now being employed on an increasing scale for the production of items for electrical switchboards, such as connecting links, bolts, studs, and contactor parts.

E.I.A. Ilford Display

More than 60 member firms of the Engineering Industries Association took part in a one-day display, organized jointly by the North East London Group and the North London Group, which was held recently at Ilford Town Hall, High Road, Ilford, Essex. In this article, attention is drawn to some exhibits likely to be of particular interest to readers of MACHINERY.

The Spirex work driver which was shown by North London Metals, Ltd., 218 Mare Street, London, E.8, is available in three sizes, with diameter capacities from 0.32 to 0.8, 0.72 to 1.2, and from 1.12 to 1.6 in. In operation, the work is held in contact with the inner ends of two screws, set at an angle to each other in cross holes in the ring-shaped body, by the wedging action applied by the cam-shaped inner end of a spring-loaded lever. The outer end of this lever is engaged by a dog on the face-plate of a lathe or a cylindrical grinder for example, for rotating the driver and the work. With this arrangement, the gripping pressure applied to the work is varied with the cutting force resulting from turning or grinding. Movement of the lever by hand enables the inner end to be swung outwards, within the bore of the body, so that it is brought clear for loading and unloading the work.

The same company exhibited the French-made Synchrolub coolant dispenser, which is here shown mounted on a grinding machine fitted with a diamond-impregnated wheel for sharpening tungsten carbide tipped saws. With this equipment, coolant from a small container, as indicated at A, is delivered to the grinding wheel in mist form directly at the point of cutting, through a nozzle, by the electrically-operated vibratory-type pump B, which is brought into use during the working travel of the wheel-head only, by means of a micro-switch. The supply is interrupted while the saw is being indexed to bring a fresh tooth to the grinding position, and the quantity of coolant delivered to the wheel at each cycle serves to wash away any metal which might otherwise become lodged between the diamond particles, and prevents heating of the work.

Synchrolub equipment can also be supplied for operation by compressed air, and containers with coolant capacities up to 1 gal. can be supplied. A maximum of 12 nozzles can be connected to the largest container in the range, by means of flexible pipes, for example, when coolant is to be delivered to different cutting tools on a multi-spindle

machine. Provision can then be made for coolant to be delivered through the individual nozzles in turn, or through all the nozzles simultaneously. Nozzles can be supplied in different lengths up to 5 in., and they can be adjusted for varying the rate of mist delivery. The nozzle has a ball-shaped attachment at one end, which is usually held between a pair of clamping plates, and with this arrangement, the unit can be set in virtually any position.

In addition to delivering coolant, the equipment may be employed for applying lubricant to forging dies and strip metal for example. When it is set up on a press, a switch or a valve for controlling the pump or the compressed air supply, can be operated from the crankshaft or the ram, in such a way that a quantity of lubricant is delivered to the metal strip at each working cycle.

Benton Engineering Co., Ltd., Tonbridge Road, Harold Hill, Romford, Essex, displayed a prototype $\frac{1}{2}$ -in. capacity, unit drilling head, which is the subject of a patent application. Designed for operation on an automatic cycle, this head has a built-in differential mechanism, which enables steplessly-variable spindle feeds within a wide range, also rapid power traverse, to be obtained. Operation of a single switch simultaneously starts the



The Synchrolub coolant dispenser is here shown mounted on a grinder for sharpening circular saws

driving motor and advances the spindle for drilling, and at the end of the rapid return travel, the motor stops. The spindle is driven by a belt from a $\frac{1}{2}$ -h.p. motor, at speeds up to 2,870 r.p.m., and axial movements, up to a maximum of 2 in., can be pre-set by means of an adjustable collar at the nose end. The entire operating mechanism is housed in the 3-34-in. diameter by 13-in. long body, and the unit has an overall length of 20½ in.

Percussion-type, high-capacitance, stud welding equipment, from the range made by Omark Industries, Inc., Portland, Oregon, U.S.A., was demonstrated on the stand occupied by Kerry's (Ultrasonics), Ltd., Stud Welding Division, Warton Road, Stratford, London, E.15. This equipment enables studs and pins in a wide variety of shapes, and diameters up to $\frac{1}{4}$ in., to be welded to metal plates with thicknesses down to 0.020 in.

At the end of a pin or stud to be welded by the Omark system, there is a small pip, the diameter and length of which is held to close tolerances, and depends upon the size of the component and the metal from which it is made. With the equipment that was demonstrated, the stud is held in a spring collet built into a hand-operated welding gun, and the latter is provided with three feet, which are brought into contact with the metal plate and ensure that the component is positioned accurately square. The welding cycle is initiated by operation of a trigger-type switch on the gun, whereupon a d.c. supply is passed to the stud, which causes an arc to be struck between the end of the tip and the metal plate. Capacitors built into the equipment are now discharged, to provide a current of 300,000 amp. per sq. in., at 80 to 90 volts, which melts the pip and metal at the end of the stud and the plate. Finally, the stud is advanced into contact with the plate at a controlled speed to complete the welding operation, and this action ensures that oxides between the surfaces are discharged outwards. A homogeneous weld is thus obtained.

Since the metal in the plate is melted for a depth of only a few thousandths of an inch, it is claimed, burning and marking of the opposite side is avoided. It follows that the equipment may be used for welding studs to parts which have been painted or made from plastics-coated metal. With the Omark system, mating component parts in steel, copper, and aluminium can be welded, without the use of ceramic ferrules. For aluminium stud welding, moreover, a supply of argon gas for shrouding the weld is not required.

In addition to portable guns, the Omark range includes bench-mounted stud welding heads, several of which may be grouped, as required, to suit particular workpieces, and arranged for auto-

matic operation. Power units for the welding guns and heads can be supplied.

Kerry's (Ultrasonics), Ltd., have recently been appointed sole distributors in this country for Omark stud welding equipment, and undertake the production of studs and pins to suit customers' requirements.

Among other companies which exhibited production equipment may be mentioned:—Process Heating & Engineering, Ltd. (electro-gas soldering and brazing equipment); Carter Press Feeds, Ltd. (strip feed unit); David Dowling, Ltd. (die-sinking and engraving machines); West London Optical & Tool Co., Ltd. (optical projectors); Kine Engineering Co., Ltd. (jig borer, drilling machine, and a sawing bench); Nonius, Ltd. (knurling tools, centre drills, and dial indicators); Allspeeds, Ltd. (variable-speed drive units); and Hancock & Co. (Engineers), Ltd. (flame cutting equipment).

Manufacturing Equipment and Living Standards

(Continued from page 467)

this total, moreover, foreign orders accounted for 190.75 million dollars, so that the value of the machine tool orders placed with American builders by American industry was 462.75 million dollars, and if a substantial rise in foreign orders is taken into account, it is found that this latter total was considerable below the corresponding figure for 1959. In view of the circumstances prevailing, and the vast extent of manufacturing industry in the U.S.A., it may seriously be questioned whether current expenditure on machine tools is adequate.

Here, the position at present is relatively more favourable. After two slack years, machine tool production rose in 1960, and for the first 10 months of the year the total was £76.6 million, representing an annual rate of £91.9 million. During the same period, new orders received totalled £123 million, or an annual rate of £147.6 million (413.3 million dollars). During the year, the excess of machine tool exports over imports was £5.5 million, and it appears therefore that the value of machines installed in British factories was of the order of £86.4 million. In 1961, it is reasonable to assume, this total will be appreciably exceeded, and the figure will be determined largely by the productive capacity of the industry. While this state of affairs is a reason for satisfaction, it gives no grounds for complacency. Without doubt, there are so many obsolete machines still in service that, if the situation is to be corrected, the maximum output of which the machine tool industry is capable will be needed for many years.

Orcutt Spline Grinder Modified for Operations on Longitudinal Ball Tracks

For grinding longitudinal ball tracks in components for Birfield constant velocity universal joints, the Gear Grinding Co., Ltd., Shirley,

Warwickshire, have supplied a modified Orcutt 20-in. spline grinding machine to Hardy Spicer, Ltd., Birmingham. A view of the modified machine, which is equipped with a special wheel dressing device and an internal grinding head, is given in Fig. 1.

An indexing head of high accuracy is mounted at one end of the table and is provided with a pneumatic diaphragm chuck in which the component, seen at the left in the close-up view in Fig. 2, can be quickly loaded and is accurately located. Compressed air at 75 lb. per sq. in. provides for opening the chuck jaws, the work being securely clamped for the grinding operation by the force exerted by the diaphragm.

As may be observed in Fig. 2, the internal grinding wheel head, which has been substituted for the standard quill, is in the shape of a letter L. The vertical portion encloses a toothed belt whereby the drive is transmitted from the normal 3 h.p. motor to a layshaft, from which the grinding spindle is driven. A spindle stub cast integral with the housing carries the bearings for the grinding wheel assembly, which incorporates a pulley and the wheel adapter. The horizontal portion of the head is designed to pass through the 3 in. diameter bore of the component. Of

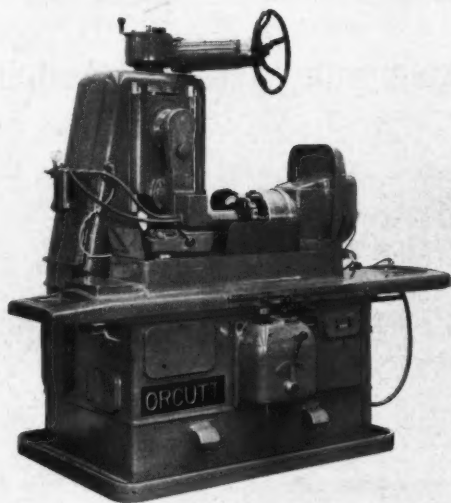


Fig. 1. Modified Orcutt 20-in. spline grinder for operations on ball tracks in components for Hardy Spicer Birfield constant velocity universal joints



Fig. 2. (right) A close-up view of the modified Orcutt spline grinder showing the diaphragm chuck and the special dressing attachment. The ball tracks which are ground on the machine may be seen in the component on the left

3% in. diameter by 0.4 in. wide, the grinding wheel is driven at 6,450 r.p.m., to provide a surface speed of approximately 5,500 ft. per min. Lubrication for the layshaft and grinding spindle bearings is provided by oil mist which is generated in an atomizer on the side of the machine column and conveyed through pipes to the grinding head.

For dressing the wheel to the required elliptical profile for grinding the ball tracks, the diamond is swung in a circular path, the vertical plane of which is inclined at the required angle to the direction of table traverse. An ellipse is thus

produced, the minor axis of which conforms to the width of the wheel.

In operation, the wheel is set by hand to take a cut of about 0.0015 in. for the first grinding pass on a longitudinal track. After each complete reciprocation of the table, the component is indexed to bring the next track into position, and when a cut has been taken on each track, the wheel is advanced, and the cycle is repeated. This procedure is continued until the work has been brought to size, and the table is then run back to the unloading position.

E.M.I. Punched Tape Control System with "Safety Angle Unit"

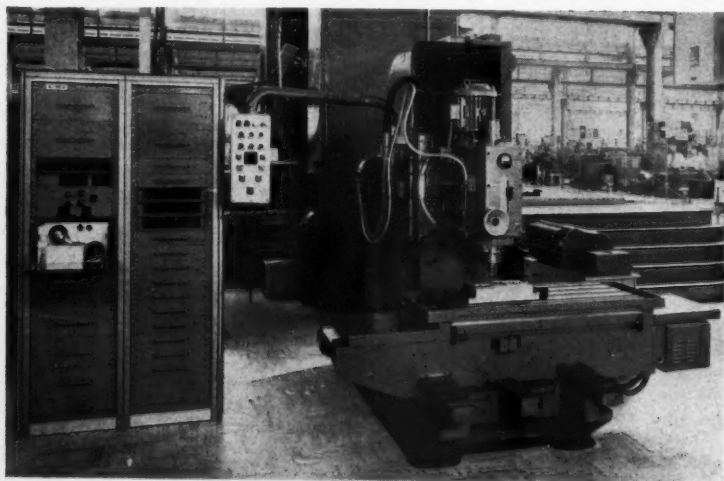
IN MACHINERY, 97/1004—2/11/60, reference was made to a Droop & Rein (German) type FS 80 N vertical milling machine equipped with the latest Emicon punched tape control system made by E.M.I. Electronics, Ltd., Hayes, Middlesex. This system incorporates a newly-developed arrangement, termed a "safety angle unit," for continuously checking the information on the tape while milling is in progress. With this unit, the machine is stopped in the event of an error in the tape being detected at the checking stage, so that the risk of producing spoiled work is avoided.

The Droop & Rein machine, set up for automatic profile milling under tape control, as shown

in the illustration, was demonstrated recently at the works of E.M.I. Electronics, Ltd. This demonstration was arranged in collaboration with Elgar Machine Tool Co., Ltd., 172-178 Victoria Road, London, W.3, who are the sole distributors in this country for Droop & Rein milling machines.

With the E.M.I. system, which has already been the subject of several articles in MACHINERY, information on the punched tape is interpolated in overlapping steps, each of which covers three closely-spaced points on a small portion of the work profile that is being machined. Following interpolation, the information is fed to the control system for the table and cross-slide (and the cutter head slide when a cavity is being machined), and the resulting movement of the workpiece past the cutter is such that a smooth profile shape is obtained. Simultaneously, the information on the tape for machining the next portion of the profile is checked by the safety angle unit prior to interpolation. If this information is such that an abrupt change in the direction of workpiece movement would result during machining, a signal is transmitted to stop the machine.

A point at which a change in direction of workpiece movement is intended during the machining cycle is encoded on the tape, and



Droop & Rein type FS 80 N vertical milling machine equipped with the latest E.M.I. Emicon punched tape control system, which incorporates an "angle safety unit"

when this information is fed to the reader, the safety angle unit is automatically put out of operation. Following the intended change in the direction of workpiece movement, the unit is once more brought into use for checking the information on the tape for machining succeeding portions of the profile shape.

The Emicon system can be supplied to give automatic control of the machine slides in any two directions of movement, and to provide for a variable intermittent feed in the third direction. Alternatively, the system can be arranged to give 3-dimensional control. Provision is made for adjusting the system for zero in the three machining axes, so that setting up of the work is facilitated. Another feature of the equipment is that movements of the slides on the machine can be adjusted by a knob on the control unit, to compensate for reductions in diameter of a milling cutter which result from sharpening the cutting edges. Variations in cutter diameter up to 1 in. are covered by the range of adjustment provided.

The FS 80 N milling machine is a standard type from the Droop & Rein range, but has been specially built for operation under tape control. As was mentioned in the earlier article, it is fitted with traversing screws and nuts of the ball-circulating type, and plastics bearing strips form the guiding surfaces for the table and saddle and the cutter head slide, to ensure smooth, sensitive movements. The 65- by 21½-in. work-table has a longitudinal travel of 39 in., and the saddle a movement of 17½ in. Table feeds up to a maximum of 15½ in. per min. can be employed for milling under tape control. The cutter head has a travel of 19½ in. on the column ways, and a maximum distance of 25½ in. is obtainable between the spindle nose and the top surface of the table.

Protection of Designs and Patents in Japan

An article under the above title, by Mr. Hiroshi Kurokawa, the London correspondent of the Japanese financial daily, *Nihon Keizai Shimbun*, was published in the January 1961 edition of the *F.B.I. Review* and gives details of a recent campaign for the protection of foreign designs in Japan. The first step was the opening of a Design Protection Exhibition in 1958 in a leading Tokyo department store, where some 20,000 visitors were shown examples of original foreign designs and the Japanese copies, side by side. The effect of this exhibition was salutary, and concerted efforts by the Government, coupled with public opinion, have since led to the establishment of an effective prevention system.

Measures adopted include the Export Commodities Design Law of 1959, and the Design Law of 1960, which provide for more positive administrative action than has hitherto been possible. It is stated, however, that comparatively few complaints relate to infringements of designs protected in the countries of origin. Some 75 per cent of complaints are of unfair competition, against which effective legal measures are difficult to devise. Foreign designs registered in Japan are completely protected under the new laws, and although only 329 of the 26,368 applications for registration received in 1959 were from overseas, the proportion is tending to increase.

Because many foreign manufacturers do not register their designs in Japan, the majority of infringement cases are not covered by the laws mentioned, and other laws are therefore invoked to prevent the export of commodities which have infringed foreign rights in the past, or might do so in the future. A total of 94 types of goods is designated under the Export Trade Control Law of 1949, on the grounds, for example, of designs, patents, trade marks, and copyright, and government approval is necessary for the export of such commodities. Another law—the Export and Import Transaction Law—prohibits unfair export transactions which might infringe industrial property rights in the countries of destination.

This law also provides for the establishment of export associations among industries, with design centres which are very effective in preventing copying. Approval must now be obtained from the appropriate centre before export of products covered by design agreements can take place. Most of the infringements of designs or trade marks, it has been found, have been perpetrated by small firms, who often made copies of foreign merchandise under contract without being aware that they were infringing rights. These small firms frequently operate on a precarious financial basis, and may be difficult to trace when complaints are received.

The 1959 law, mentioned above, enables the government to exercise control over all the manufacturers of a specified commodity, including those who do not belong to the particular industry association.

The Japanese patent system, it is stated, has developed over 75 years to a position in which it is comparable with those of other advanced industrial nations. Language difficulties and delays may cause some apprehension to foreign applicants for patents, but plans are in hand for speeding up the handling of applications under a revised Patent Law which was introduced in April, 1960. Under this law, the situation will be judged from an

international viewpoint, and rights will no longer be granted where the description of an invention has been published abroad, whether the publication has been distributed in Japan or not.

Patent application will be permitted for related plural inventions, for the greater convenience of both Japanese and foreign applicants. In addition, the new law assumes that infringements are attributable to negligence by the infringer, and that his profits from the use of the invention are the amount of damages suffered by the patentee, the cost of a licence to work the patent being regarded as the minimum. The life of any patent is limited to 15 or—in exceptional cases—20 years, from the date of filing of the application.

Letters to the Editor

[The Editor does not hold himself responsible for the views expressed by his correspondents.]

Origin for Dimensions

(To the Editor of MACHINERY)

SIR,—The diagram in MACHINERY, 98/158—18/1/61, in the article "American Special Machine Tool Standards," gives dimensions from right to left. There may be a good and sufficient reason for this procedure, but I am afraid that international standardization on the very groundwork may go off the rails again.

In the introduction to graphs, every schoolboy is taught to put the origin near the bottom left-hand corner of the page, marking the vertical co-ordinates from bottom to top and the horizontal co-ordinates from left to right, *i.e.*, in the first quadrant. It is the natural thing to do—the common rule reads from left to right. We make most graphs that way, and are accustomed to reading them that way. A series of holes in a plate, dimensioned and machined from H and V co-ordinates, is a kind of graph.

Thirty years ago, when the jig-borer was coming into the toolroom, I used to dimension drawings from left to right, bottom to top, lettering each position and giving a table of holes sizes. This system resulted in a cleaner drawing, with less chance of mistake. Recently, however, in this country, I have seen drawings dimensioned both ways, always from bottom to top, but with the origin sometimes at the left-hand and sometimes at the right-hand side. This point should be resolved before we get too heavily committed to change it. When I raised the question I was told that on a particular machine the origin *had* to be on the right. At the first opportunity I talked to the designer of the machine (at the 1960 Olympia

Exhibition) and was told I could have the origin where I liked—it was simply a matter of changing connections to a couple of wires.

As in connection with many things for which we could establish useful conventions at the start, I get the answer: "What does it matter, anyway," and I think of Raymond Chandler, in another connection: "If you don't consider these things important, then what the hell is important?"

How important, for instance, are unified letter symbols for gear engineering? I attempted to raise this matter in a letter published in MACHINERY, 75/432—22/9/49. At that time A.G.M.A. 111-01 had been in existence for six years. B.S. 2519 came out in 1954 (eleven years after the A.G.M.A. specification) and, of course, it had to be different. I use the American system, from long association with it from the time when there was no other, but I can juggle the American, British, and German symbols, they are all the same to me. The student, starting out now, however, has a difficult road confronting him. These artificial differences could have been easily smoothed away, at the right time.

A. M. GUNNER.

Rugby.

Trade Publications

F. J. EDWARDS, LTD., 359-361 Euston Road, London, N.W.1.—Catalogue MT 1260 includes illustrations of a wide range of new and used machine tools and allied equipment.

E. N. MASON & SONS, LTD., Arclight Works, Colchester, Essex. Folder describing the Mercury continuous reproduction unit and its applications for providing inexpensive dyeline prints, for example in the offices of engineers, architects, and surveyors.

G. A. HARVEY & CO. (LONDON), LTD., Greenwich Metal Works, London, S.E.7.—Brochure entitled "The Harvey Team," which gives brief notes on the work of the founder, George Alfred Harvey, and photographs of the present board of directors. Reference is then made to the products and managers of the numerous departments.

DUBBELDEE DIAMOND CO., LTD., Lichfield, Staffordshire. Informative booklet of 32 pages entitled "diamonds for industry". Sections are devoted, for example, to rough diamonds, diamond sorting, importance of classified diamond selection, modern diamond tool manufacture, and a list of products. The latter include single and multi-diamond wheel dressing and truing tools, shaped and profiling tools for dressing wheels for special purposes, diamond turning and boring tools, indenters for hardness testing, hard metal diamond impregnated dressing tools, diamond powders, diamond wheels, glass drills and glass cutting tools, and diamond compounds for various purposes. The company is associated with D. Drukker & Zn., N.V. Amsterdam.

NEWS OF THE INDUSTRY

Manchester and District

RELIANCE GEAR & ENGINEERING CO. (SALFORD) LTD., Dickinson Street, Springfield Lane, Salford, 3, report a continued heavy demand for their services as gear specialists from all branches of the engineering industry. To meet the increasing production requirements an extensive building extension and plant replacement programme is being carried out. This programme also provides for a substantial addition to the commercial offices, and modern canteen facilities.

We are informed that production of accurate gears ranging up to 12 in. diameter is now well established on the recently installed battery of Sykes precision gear cutting machines. In addition, the company is now producing straight bevel gears of Coniflex form up to a maximum of 35½ in. outside diameter by 6 in. face width by 1½ d.p. It was noted that the following machines have recently been installed in the works: a Gleason bevel gear planer; a David Brown M.T.30 gear hobbing machine; a Dowding gear hobbing machine; and a Webster & Bennett 48-in. capacity vertical turning and boring mill.

CUNLIFFE & CROOM, LTD., Edward Street, Salford 7, report a steady request for their range of standard milling machines, and a large volume of orders for the recently introduced high-speed vertical machine. In addition to the standard types, special milling machines are designed and built to the requirements of individual customers.

There is also a regular demand for the various accessories which this company makes, including dividing heads. Machines and equipment recently installed in the works included a Herbert 2 D capstan lathe.

H. WOOLLACOTT & CO. (GEAR CUTTERS), LTD., Mosley Road, Trafford Park, are maintaining a high rate of production of various types of gears, which are manufactured complete, or cut from customers' blanks in various materials, including nylon and Perspex.

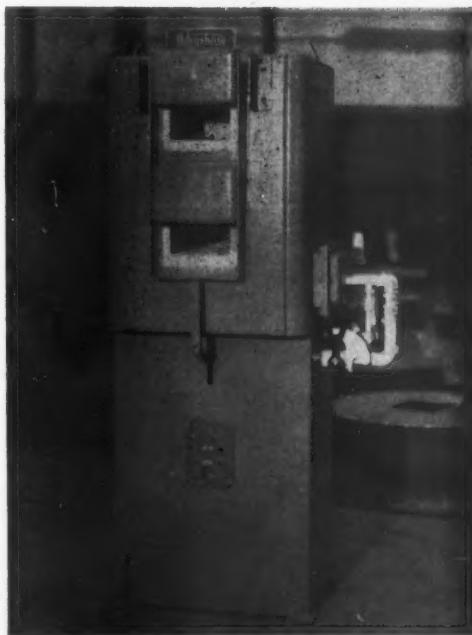
WM. PARTINGTON, LTD., Trafford Park, report that the volume of orders received for both new and re-conditioned machine tools is still at a high

level. Recent despatches from the works have included a number of machines for export to various Continental countries.

ROBERT KELLY & SONS, LTD., Excelsior Works, Hulme Hall Road, Chester Road, Manchester, 15,



The accompanying illustration shows the recently re-designed Brayshaw type 60, gas and air-blast heated, twin chamber, high-speed steel hardening furnace. Both chambers have insulated doors which are linked together and operated simultaneously from a pedal. The doors are counter-balanced, and return to the closed position when the pedal is released. The upper or pre-heating chamber is heated by the waste products of combustion from the main chamber, the latter being suitable for temperatures ranging from 1,200 to 1,400 deg. C. The burners are arranged for operation on town gas, but can be adapted to use bottled gas, if required.



stockists and merchants of machine tools, small tools, and engineering equipment, inform us that the recent increase in the demand for all the products which they handle has been maintained, and special reference is made to the rise in the volume of orders for micrometer and vernier type gauging equipment.

This company now stocks the range of Starrett hack-saw blades, and has issued new literature covering the Mark 6 shrinking machine.

MATHER & PLATT, LTD., Park Works, Manchester, 10, are busy with the production of their range of machinery and equipment which includes various types of machines for the textile, rubber, chemical, paper, and edible oil industries; turbine and centrifugal pumps for various duties; electrical equipment, such as d.c. dynamos, polyphase and single-phase generators; d.c. polyphase and synchronous motors, rotary converters, and Ward Leonard sets; fire protection equipment; and machinery for the canning, freezing, dehydrating and packaging of food.

We are informed that export orders account for a considerable proportion of the company's trade, and reference was made to the large numbers of electric motors and pumps at present on order for India, Canada and Australia. For a number of years, the firm has been exporting various products to the U.S.S.R., and will be exhibiting on a stand of some 2,000 sq. ft. area at the forthcoming British Trade Fair in Moscow.

DAVID BROWN MACHINE TOOL DIVISION, Britannia Works, Sherborne Street, Manchester, 3, report an unparalleled demand for all the machine tools in their range. It was noted that the current production programme includes a P.12.H. horizontal turbine pinion hobbing machine, which is the first of its type, and an M.T.50. (60-in. capacity) gear hobbing machine, both for Demag, Western Germany, also a further M.T.50. machine for another customer in Western Germany. We hope to refer to the P.12.H. machine in a future issue.

RINGWAY MACHINE TOOLS, LTD., 42 Barton Arcade, Deansgate, Manchester, 3, a recently formed company, are the United Kingdom agents for Heid copying lathes and Heid tracer control units. We are informed that the volume of orders and enquiries for the copying lathes is so far satisfactory. In addition, orders are now in hand for a number of tracer control units, and many enquiries for this equipment are being received.

The company is shortly to start production in this country of the Heid Electro-magnetic multi-disc clutches. These clutches have no slip-rings, and it is stated that the residual torque is less than 1 per

cent of the rated transmission torque, and that the engagement or slipping torque is 70 per cent of the transmission torque, a 30 per cent reserve being thus provided for taking up peak loads.

R. SUTCLIFFE.

London and the South

BRITISH GEAR GRINDING & MANUFACTURING CO., LTD., Standard Road, Park Royal, N.W.10, are still extremely busy with the production of spur gears and single helical gears for traction work, hosiery machinery and computers, for example. Master gears for precision rolling gear testing machines are also in progress. The shops are equipped with machines which provide for tooth correction either in the form of involute modification or crowning, or combinations of both, to suit customers' requirements. Gears are frequently accepted for tooth profile grinding only, and the capacity for such work has recently been increased to cover gears up to 48 in. diameter by 12 in. face width, by 1.3 d.p. Structural alterations and extensions to the premises have provided an increase in production space, and the administrative offices have been re-sited on a higher level.

NEWBURY ELECTRONICS, LTD., West Mills, Newbury, Berks., are now well established in their recently acquired shops, which provide better manufacturing facilities than those available previously. The principal activity of this company is the design and production of printed circuit boards of the type now widely employed by manufacturers of electronic control apparatus. The demand for these circuit boards, it is stated, is well maintained.

L. M. VAN MOPPES & SONS (DIAMOND TOOLS), LTD., Basingstoke, Hants, are fully occupied with the production of a comprehensive range of diamond tools for industrial applications, including diamond drilling equipment for mining, oil well drilling, and civil engineering work. Examples of all the company's products are to be shown at the forthcoming British Trade Fair in Moscow. New premises adjoining the main works at Basingstoke provide for increased production and research. The new building also accommodates Holmasters, Ltd., who market the diamond drilling bits and equipment specifically for the building and civil engineering industries. Additional building is planned to provide for further increase in production in accordance with the company's policy of planned expansion.

Precidia S.A., who formerly operated from Paris 18, recently occupied a new factory designed for diamond tool production at Lisieux, Normandy.

The facilities provided by the new factory, which at present has a works section with an area of 6,400 sq. ft., are superior to those of the original Paris establishment, and include a laboratory with electrolytic deposition equipment.

In Australia, Commonwealth Diamond Tools Pty., Ltd., have moved to a new factory in Sydney and production of diamond tools has been resumed with only slight dislocation of manufacturing schedules.

F. W. HERRIDGE.

New Companies Registered*

PRECISION ENGINEERS (PONTEFRACHT), LTD., 1 Market Place, Pontefract. Registered February 1, 1961. Nom. cap.: £2,000 in £1 shares. Directors: D. C. Denman and K. Beaumont.

SHEPPERSON TOOLS, LTD., 188 St. Bernards Road, Solihull, Warwickshire. Registered February 10, 1961. To carry on the business of manufacturers of, and dealers in, engineering, machine, hand and other tools, etc. Nom. cap.: £1,000 in £1 shares. Directors: A. E. Shepperson and G. Shepperson.

BUHLER BROTHERS (ENGLAND), LTD. Registered February 13, 1961. To take over the business carried on in England as Buhler Brothers; to carry on the business of manufacturers of machinery and equipment, and in particular that used in the milling trades, etc. Nom. cap.: £20,000 in £1 shares. Directors to be appointed by subscribers. Subscribers: X. Speckert, 2 Garden Court, Temple, London, E.C.4, and J. J. Moreton, Saddlers Hall, Gutter Lane, London, E.C.2.

*From the lists compiled by Jordan & Sons, Ltd., Company Registration Agents, 116-118 Chancery Lane, London, W.C.2.

Personal

MR. D. L. CAMPBELL has resigned from the board of Campbell, Gifford & Morton, Ltd., consulting engineers, 52 Queens Road, Weybridge, Surrey, on his appointment as managing director of Davy-Ashmore Export Co., Ltd.

MR. R. S. MONTGOMERIE, the London area manager of E.M.B. Co., Ltd., Moor Street, West Bromwich, Staffs., will retire at the end of April on account of indifferent health, but will continue to serve the company on a part-time basis. He will be succeeded as London area manager by his assistant, Mr. P. N. Jay.

Corrections

In the advertisement for Metco, Ltd., Chobham, Woking, which appears on p. 4 in this issue of MACHINERY, the key No. E 12 on the coupon is incorrect. It should be E 13.

In MACHINERY, 98/327—8/2/61, reference was made to a Solex Cybermetric sorting machine. We have been informed that the operating speed of this machine was stated incorrectly, and should have been given as 780 to 850 pieces per hour.

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

The Price of a Subscription to MACHINERY is 52 Shillings per annum, post free, to any part of the world.

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1/3/61

MANUSCRIPTS FOR BOOKS covering all branches of engineering production will receive careful consideration and should be sent to the Manager, Book Dept., MACHINERY, National House, 21 West Street, Brighton, 1.

CONDITIONS OF SALE AND SUPPLY.—MACHINERY is sold subject to the following conditions

That it shall not, without the written consent of the publishers first given, be lent, resold, hired out or otherwise disposed of by way of trade except at the full retail price of 1s. 3d. and, that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of trade; or affixed to or as part of any publication or advertising literary or pictorial matter whatsoever.

Industrial Notes

HIGH DUTY ALLOYS, LTD., Slough, Bucks., inform us that the telephone number of their Extrusion Division at Distington has been changed to Workington 2581/6.

THE PLESSEY CO., LTD., Ilford, inform us that they have received a further production order from Alfred Herbert, Ltd., for six machine tool control systems, which will bring the total number supplied up to 18. This equipment is employed for accurate programme control on Herbert De Vlieg Jigmills.

THE ENGINEERING INDUSTRIES ASSOCIATION, North Herts. and District Group, will hold a one-day display at the Town Hall, Brand Street, Hitchin, on March 15, starting at 2.0 p.m. Particulars may be obtained from Mr. E. F. Crouch, Colorflo, Ltd., Bessemer Works, Whinbush Road, Hitchin, Herts.

PRACTICAL PLATERS' NIGHT.—The London Branch of the Institute of Metal Finishing will hold their 5th annual "Practical Platers' Night" on March 10 at The Constitutional Club, 28 Northumberland Avenue, W.C.2. The meeting starts at 6.30 p.m. Full particulars and tickets (price 15s.) can be obtained from Mr. J. M. Shepherd, 18 Bentham Avenue, Sheerwater, Woking, Surrey.

W. E. NORTON (MACHINE TOOLS), LTD., Grosvenor Gardens House, Grosvenor Gardens, London, S.W.1, inform us that they recently purchased what they believe to be one of the largest and most valuable groups of machine tools to be acquired in a single private transaction since the war. It is stated that the purchase includes many single- and multi-spindle automatics.

H. W. KEARNS & CO., LTD., Broadheath, Manchester, inform us that a type 451P Optimetric horizontal surfacing, boring, milling, drilling, and tapping machine will be shown at the Tokyo Trade Fair, to be held in April, by their Japanese agents, Siber, Hegner & Co., Ltd. This machine has already been described in *MACHINERY*, 96/1510—22/6/60, in connection with the 1960 International Machine Tool Exhibition at Olympia.

W. G. CANNON & SONS, LTD., 38a St. George's Drive, London, S.W.1, a member company of the Chamberlain Group, have introduced a new range of transportable man-cooler fans with aperture diameters of 18 or 22 in. and tripod or cradle mountings. These fans are primarily intended to provide improved conditions for workers in foundries, or in close proximity to furnaces and steam-raising plants.

MANAGEMENT CONSULTANTS ASSOCIATION, 4 London Wall Buildings, London, E.C.2, have issued a leaflet entitled "Are Incentives Worth While?" Notes are included on the range of incentive schemes, the aims of incentives, the scope for incentives, preparation for incentives, maintenance of incentives, and the problems to be overcome. Copies of the leaflet are obtainable, free of charge, from the Secretary, at the above address.

INFORMAL DISCUSSION ON CYBERNETICS.—The Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London, S.W.1, have announced that the Industrial

Administration and Engineering Production Group will hold an informal discussion on "Human Capabilities and Limitations in Industrial Operations." This discussion will take place in the main meeting hall of the Institution on March 13, starting at 10 a.m. Further particulars can be obtained from the Secretary at the above address.

STEIN ATKINSON VICKERS HYDRAULICS, LTD., will hold a special one-day course, designed to outline the advantages and possibilities of oil-hydraulic power and control systems in industry, on April 27, in the Lecture Hall, at the new Birmingham district office of the company. Applications are invited from management personnel responsible for making policy decisions on the design or marketing of industrial plant and machinery, and should be addressed to the Engineering Lecturer, Stein Atkinson Vickers Hydraulics, Ltd., 197 Knightsbridge, London, S.W.7.

STEEL AND PIG IRON PRODUCTION.—Figures issued by the Iron and Steel Board show that the production of crude steel in January averaged 478,400 tons a week, representing an annual rate of 24,876,000 tons. The corresponding figures for December were 451,100 and 23,459,000 tons, and for November, 504,500 and 26,234,000 tons.

Pig iron output in January averaged 308,500 tons (an annual rate of 16,040,000 tons) as compared with 306,000 tons (15,912,000 tons) in December, and 315,000 tons (16,382,000 tons) in November.

WILD-BARFIELD ELECTRIC FURNACES, LTD., Watford, Herts., inform us that as a result of the successful operation of pit type gas carburizing furnaces which they supplied some time ago to the order of the East Indian Produce Co., Ltd., for installation at the works of National Engineering Industries, Ltd., Jaipur, they have received a further order for larger furnaces. The latter will have nominal working dimensions of 36 in. diameter by 54 in. deep. All these furnaces are required for gas carburizing components of rolling stock axle bearings for the Indian railways, and operate with the company's Carbo-drip drip-feed gas carburizing liquid.

Machine Tool Orders

Net new orders for machine tools in November were valued at £11,236,000, of which export orders accounted for £2,375,000. Deliveries during the month amounted to £9,015,000, including £2,606,000 for export. The value of orders in hand at the end of the month rose to £103,708,000, of which £22,934,000 was for export.

Coming Events

INSTITUTION OF PRODUCTION ENGINEERS. Preston Section. March 8, at 7.30 p.m., at the Harris College, Corporation Street, Preston; lecture on "Recent Developments in U.S.S.R." by Dr. D. F. Galloway. **Ipswich and Colchester Section.** March 10, at 7.30 p.m., at Electric House, Ipswich; lecture on "The Status of the Production Engineer in any Sort of Economy," by H. Burke.

A.B.M.T.M. Board Changes

Following the acquisition by the Birmingham Small Arms Co., Ltd., of the capital of The Churchill Machine Tool Co., Ltd., Sir Greville S. Maginness, K.B.E., has resigned from the position of chairman of the latter company, also from Associated British Machine Tool Makers, Ltd., 17 Grosvenor Gardens, London, S.W.1. Mr. Edward Parkinson is also resigning from the A.B.M.T.M. board for private reasons.

At a recent meeting of the A.B.M.T.M. directors, Mr. J. W. Butler was elected chairman, and Mr. E. Williams, deputy chairman.

Keighley Grinders Extensions

In **MACHINERY**, 98/392—15/2/61, reference was made to a new fitting and assembly bay which is now under construction at the Keighley works of Keighley Grinders (Machine Tools), Ltd. We are asked to point out that the area of this new bay will be approximately 9,000 sq. ft., and not 5,000 sq. ft., as stated. In addition the company has recently purchased an adjacent site with an existing building, which provides further working space, also an adequate area for future expansion.

Obituary

MR. E. LLYN RAWORTH, chairman and joint managing director of McCall & Co. (Sheffield), Ltd., Templeborough, Sheffield, died recently. A founder director of the company in 1922, he became chairman in 1941.

MR. JUSTUS SJÖGREN, chairman of Sandvik Swedish Steels, Ltd., Halesowen, Birmingham, and of Sandvik Steel Band Conveyors, Ltd., Selly Oak, Birmingham, died recently at the age of 82. He came to this country and pioneered the development of the Sandvik organization here. Mr. Sjögren held the offices of chairman and managing director of Sandvik Swedish Steels, Ltd., from 1914 to 1947, when he relinquished the latter post.

New Appointments

The following appointments have been announced:—

MR. COLIN BROOME as representative in Yorkshire for The Globe Pneumatic Engineering Co., Ltd., Ashton Road, Harold Hill, Romford, Essex. He will be based in Leeds.

MR. DENNIS W. GRAY, A.M.I.Mech.E., as works director, and MR. RICHARD R. WATKINS, M.S.M.A., as sales director of Chamberlain Industries, Ltd., Staffa Works, Argall Avenue, Leyton, London, E.10.

MR. G. K. ROBINSON as Newcastle branch manager for Square D, Ltd., Cheney Manor, Swindon, Wilts. He previously operated from the company's London field office as a field engineer.

MR. R. M. I. HOBILL to the board of Ferranti, Ltd., Hollinwood, Lancs. He joined the company in 1929, and has held various posts including (latterly) that of manager of the Transformer Department.

MR. R. J. W. PACKARD, as technical representative to cover the whole of Western Europe for the Lapointe Machine Tool Co., Ltd., Watford, Herts. He has been with the company for more than 7 years and latterly held the position of chief draughtsman. MR. G. A. STONEBRIDGE, who has also joined the sales staff, will be the company's technical representative in the North Midlands.

MR. R. P. NEWMAN, A.M.I.Mech.E., as head of the Members' Service Department of the British Welding Research Association, Abington Hall, Cambridge, in succession to Mr. P. H. R. LANE, B.Sc. (Eng.), A.I.M., A.M.Inst.W., who has become the first director of research for the Drop Forging Research Association, Hoyle Street, Sheffield, 3.

Scrap Metals

†LONDON.—†Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £195; clean heavy copper, untinned and free from lead and solder, £190; copper wire No. 2, £184; clean light copper, £180; brazier copper, £168; gunmetal, £175; brass, mixed, £124; lead, net, £52; zinc, £43; cast aluminium, £100; old rolled aluminium, £103; battery lead, £26; unsweated brass radiators, £100; hollow pewter, £535; black pewter, £410.

MIDLANDS.—The continued improvement in copper market prices has been due almost entirely to the political situations in the Congo and Rhodesia which have resulted in a feeling of insecurity in connection with a metal which is really in over-supply. This anxiety has also affected tin and has been responsible for recent price increases. With the motor car trade showing signs of improvement earlier than was expected, although slight at present, hopes have been raised for the future. At present, market indications for various metals are as follows:—

Copper: General demand is good and more interest is being shown in brazier copper, but No. 2 wire is not much in request. While the above-mentioned political situation exists prices may rise further.

Brass: Prices for the most part have increased by about £3 per ton, interest still being centred in mixed brass.

Gunmetal: Demand has been maintained and prices are a little higher, reflecting the increases in copper and tin.

Lead: Market prices have been firmer to the extent of £2 to £3 per ton over the past two weeks, and this increase may have induced merchants to dispose of some stock which was held over while prices were low. A period with no substantial increase in value still seems to be in prospect.

Aluminium: Demand is only fair, and there has been hardly any improvement in prices. Small engineering firms, where production of this scrap is continuous, as well as merchants, tend to hold material in the hopes that values will rise. Buyers are not keen to secure quantities above what is necessary to meet present requirements.

Zinc: The general tone of the market is steady, and the recent advances in prices, amounting to about £4 per ton, are being maintained.

† George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.11.
‡ Subject to market fluctuations.

Machine Tool Share Market

Stock markets were firm and generally cheerful during the period under review, and a good level of business was maintained in most sections. British Government stocks were well supported, and Home Corporation and Dominion loans also received attention, which led to an improvement in values.

Commercial and industrial share markets developed a bright tendency with the general trend upwards as a result of sustained investment buying, and there have been several prominent features on account of favourable company news, and other special factors.

Among machine tool issues, Edgar Allen advanced 1s. 3d. to 40s. 3d.; Arnott & Harrison, 3d. to 13s. 6d.; Birmingham Small Arms, 6d. to 31s. 6d.; British Oxygen, 2s. to 30s. 6d.; Brooke Tool, 6d. to 7s. 4½d.; Chas. Churchill, 1s. to 10s. 1½d.; Clarkson (Engineers), 1s. 3d. to 28s. 9d.; Coventry Gauge & Tool, 9d. to 27s.; Craven Bros. (Manchester), 4½d. to 10s. 4½d.; Expert Tool, 6d. to 2s. 6d.; Alfred Herbert, 5s. to 65s.; Kerry's (Great Britain), 1s. 3d. to 11s.; B. & S. Massey, 6d. to 10s. 6d.; W. E. Norton (Holdings), 4½d. to 4s. 1½d.; Samuel Osborn, 2s. 6d. to 46s.; F. Pratt, 6d. to 15s. 6d.; Sanderson Kayser, 3s. 1½d. to 37s. 6d.; Ambrose Shardlow, 1s. 3d. to 46s. 3d.; and Sheffield Twist Drill, 6d. to 16s. 6d.

GEORGE COHEN 600 GROUP, LTD. Interim dividend 4½ per cent (same).

ALFRED HERBERT, LTD. Final dividend 6 per cent (tax free), making, with the interim, a total distribution of 8½ per cent (tax free) for the year ended October 31 last, as compared with 7 per cent (tax free) for the previous year.

Kennametal (Great Britain), Ltd.

The whole range of Kennametal products is now being sold exclusively in this country through Kennametal (Great Britain), Ltd., 82-84 Coleshill Street, Birmingham 4. A comprehensive catalogue gives particulars of the range of standard tools and tips of accepted British patterns, also full information on the grades available, with particulars of the colour code employed, and recommendations for selection. There is also a table of speeds for steels at different hardness values. An illustrated standard tools index greatly facilitates reference, and details are given, in the pages which follow, of a wide variety of lathe tools, also planing tools, spot facing cutters, jig boring tools, twist drills, reamers and centres. There is a separate section concerned with standard Kennametal tips and Kengrips for holding clamping and feeding devices.

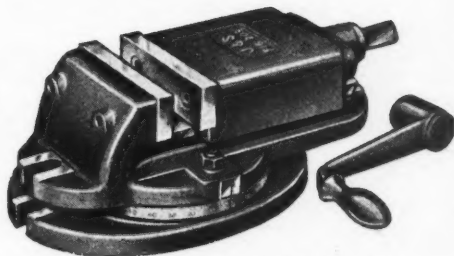
A separate publication, known as the Kennametal tool manual, gives useful information under such headings as: tool selection, machining hints, tool performance, grinding, chip breakers, and brazing.

COMPANY		Denom.	Middle Price	COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/3	Herbert (Alfred), Ltd.	Ord.	£1	65/-
Allen (Edgar) & Co., Ltd.	Ord.	£1	40/3	Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	16/3
	5% Prf.	£1	14/-*	" " "	"B" Ord.	5/-	16/3
Arnott & Harrison, Ltd.	Ord.	4/-	13/6	Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	32/6
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	12/6	" " "	7% Cum. Prf.	5/-	4/9
Birmingham Small Arms Co., Ltd.	6% Cum. Prf.	£1	16/3	Kearney & Trecker-C.V.A., Ltd.	5½% Rad. Cum. Prf.	£1	11/-
" " "	Ord.	10/-	31/6	Kearns (H. W.) & Co., Ltd.	Prefd. Ord.	£1	13/9
" " "	5% Cum.	£1	14/6	Kerry's (Gt. Britain), Ltd.	Ord.	5/-	18/9
" " "	6% Cum.	£1	16/6	Macready's Metal Co., Ltd.	Ord.	5/-	11/-
" " "	4% 1st Mort. Deb.	Stk.	90½	Martin Bros. (Machinery), Ltd.	Ord.	5/-	16/-
British Oxygen Co., Ltd.	Ord.	5/-	30/6	Massey (B. & S.), Ltd.	Ord.	2/-	2/-
Brooke Tool Manufacturing Co., Ltd.	6% Cum. Prf.	£1	20/-	Newall Engineering Co., Ltd.	Ord.	2/-	7/6
Broom & Wade, Ltd.	Ord.	5/-	7/4½	Newman Industries, Ltd.	Ord.	2/-	5/3
" " "	6% Cum. Prf.	£1	17/-	" " "	6% Prf. Ord.	5/-	5/-
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/-	Noble & Lund, Ltd.	Ord.	2/-	5/6
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-	Norton, W. E. (Holdings), Ltd.	Ord.	2/-	4/1½
Butler Machine Tool Co., Ltd.	Ord.	5/-	17/6	Osborn (Samuel) & Co., Ltd.	5½% Cum. Prf.	£1	25/-
Churchill (Charles) & Co., Ltd.	5% Cum. Prf.	£1	14/3	" " "	Ord.	5/-	15/6
Churchill Machine Tool Co., Ltd.	Ord.	2/-	10/1½	Pratt (F.) & Co., Ltd.	Ord.	5/-	15/6
" " "	6% Cum. Prf.	£1	25/9½	Sanderson Kayser, Ltd.	Ord.	10/-	37/6
Clarkson (Engrs.), Ltd.	Ord.	5/-	39/6	Scottish Machine Tool Corporation Ltd.	6½% Cum. Prf.	£1	18/-
Cohen (George), 600 Group, Ltd.	6% Cum. Prf.	£1	17/6	" " "	Ord.	4/-	10/-
" " "	Ord.	5/-	13/3	Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	46/3
Coventry Gauge & Tool Co., Ltd.	4½% Cum. Prf.	£1	13/-	Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	16/9
" " "	Ord.	10/-	27/-	Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	16/6
Craven Bros. (Manchester), Ltd.	5% Cum. Red. Prf.	£1	16/3	" " "	5% Cum. Prf.	£1	13/9
Elliott (B.) & Co., Ltd.	Ord.	5/-	10/4½	Stedall & Co., Ltd.	Ord.	5/-	8/9
" " "	4½% Cum. Prf.	£1	3/1½	Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	24/-
Expert Tool & Case Hardening Co., Ltd.	4½% Cum. Prf.	£1	13/-	Tap & Die Corporation, Ltd.	Ord.	5/-	15/3xd
Firth Brown Tools, Ltd.	Ord.	2/-	2/6	" " "	4½% Deb. 1961-1977	Stk.	84½
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Harper (John) & Co., Ltd.	Ord.	£1	24/9xd	Ward (Thos. W.), Ltd.	Ord.	£1	70/-
" " "	4½% Red. Cum. Prf.	£1	8/1½	" " "	5% Cum. 1st Prf.	£1	14/-
" " "	Ord.	£1	12/3	" " "	5% Cum. 2nd Prf.	£1	22/-
				Willson Lathes, Ltd.	Ord.	1/-	3/4½

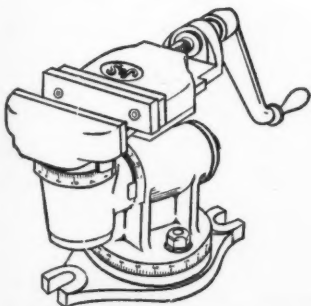
The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

machine vices

The range of J & S Machine Vices covers all kinds from precision types for light grinding operations to heavy duty models for use on Milling and Planing Machines.

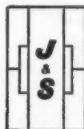


Milling Machine Vices are manufactured in two types, plain and swivel, in a variety of capacities. An Angular Sine Vice is available for extreme precision work. Stock Deliveries from all J & S Small Tool distributing Agents.



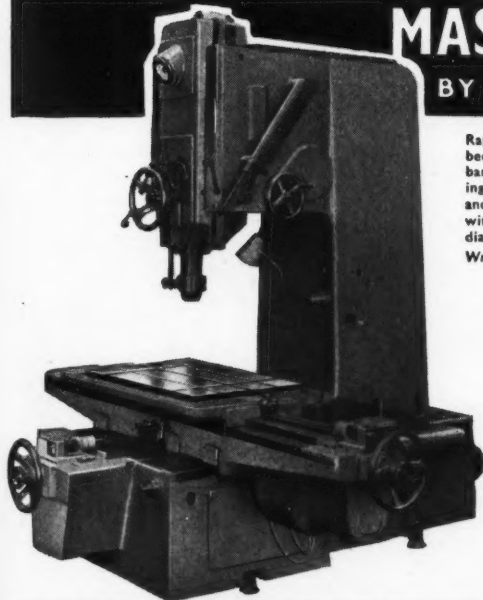
small tools

A. A. JONES & SHIPMAN LTD.,
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Telephone: Leicester 823222.
Telegrams: "CHUCK" Leicester.



MASTER BAR Jig Borer

BY BUSWELL & SWEENEY

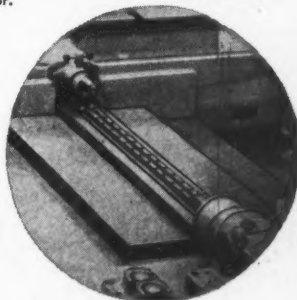


Rapid, super-accurate setting facilitated by new Master Bar system. Accurate because it returns to first principles in the use of gauge blocks and large barrel micrometer: rapid because this time-proven method incorporates an ingenious electro-mechanical system which eliminates the handling of blocks and provides automatic power cut-out and table braking when the table is within 0.01in. to 0.02in. of the required position. Final adjustment is by large diameter handwheel and dial indicator.

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Table size: 25in. by 42in.
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Steplessly variable spindle speeds up to 1,800 r.p.m.
Feeds (4) from 0.001in. to 0.008in.
Power setting traverse 60in. per min.
Floor space: 115in. by 115in.



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Sole Selling Agents
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88% on tools!
 Save
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NO DOUBT ABOUT IT, Crosland dies cut costs as cleanly as materials for these important reasons. They blank and pierce in one operation. They are an amazingly cheap method of tooling steel, non-ferrous and non-metallic materials. They save up to 96% bench time compared with hand methods on short to medium non-repetitive runs.

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High Speed
BANDSAW

- * POSITIVE CONTROLLED HYDRAULIC FEED
 GIVES SUPER FAST CUTTING ON BARS
 TUBES, ANGLES AND SECTIONS
- * NO WASTE: CUT ONLY 0.05in. WIDE
- * ACCURATE: TO WITHIN ± 0.005 in. on 4in. BAR

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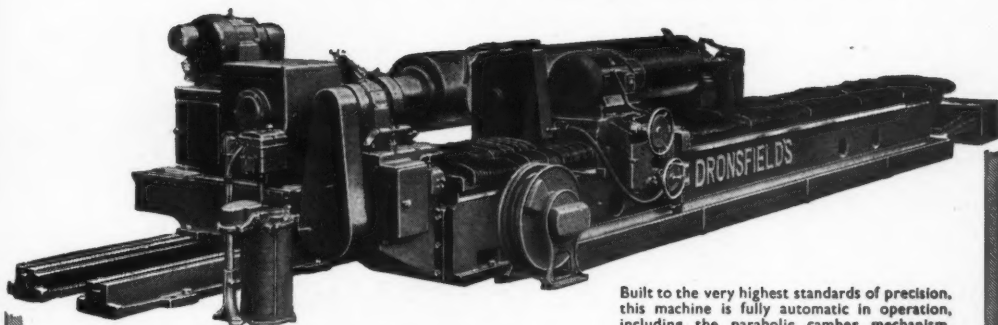


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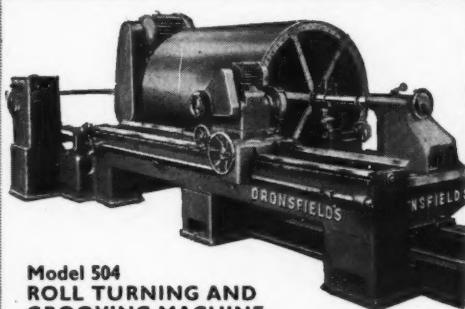
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* ***THE name for Roll Grinding and Turning Machines***



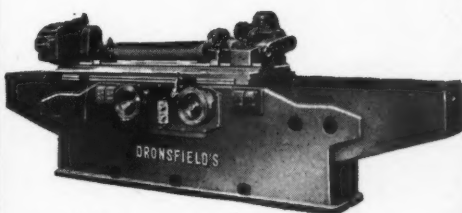
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B & T Anchor Bushes are either welded or riveted to a thin steel or aluminium template thus providing a very low cost drill jig which is light to handle and which can be easily formed to suit any shape.

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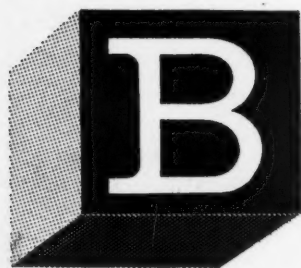
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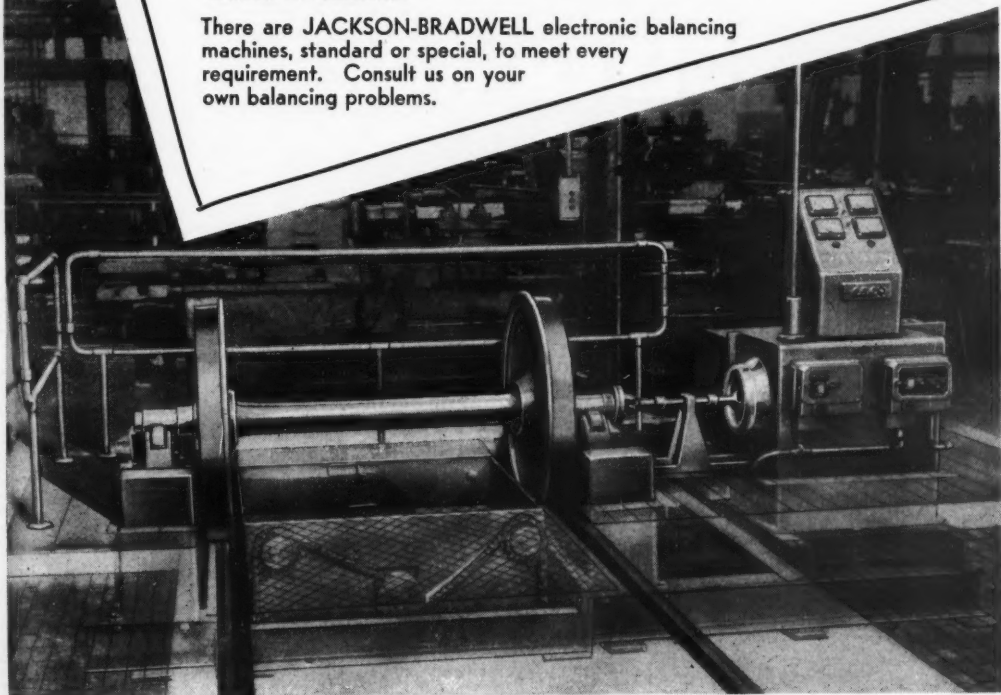
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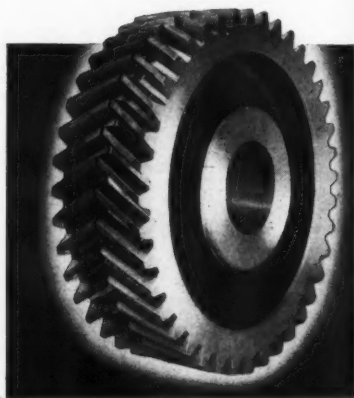
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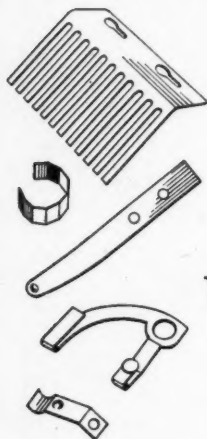
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The Specialist Firm for
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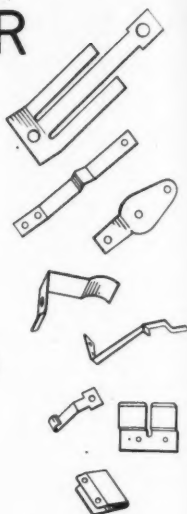
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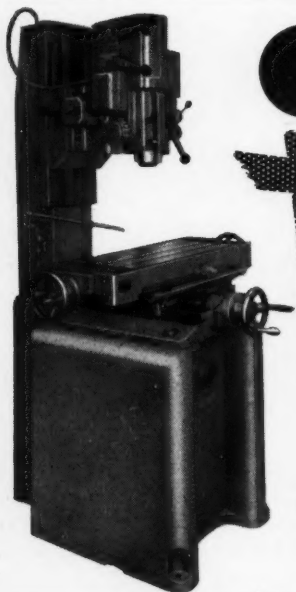
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also available as Rod, Wire and Castings

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CO-ORDINATE DRILLING & BORING MACHINE

SERIES II

Some Features of Interest

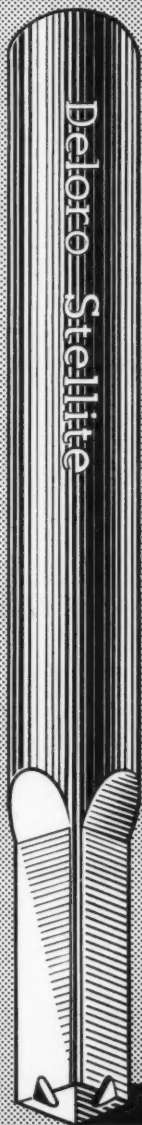
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Table Working Surface	32in. x 12in.
Longitudinal Movement	20in.
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FULLY HARDENED STEEL
CASE HARDENED STEEL
MANGANESE STEEL
CHILLED IRON
BROKEN TAPS
DIE SET DOWELL HOLES

send for publication B.19

it produces clean, limit holes with mirror finish

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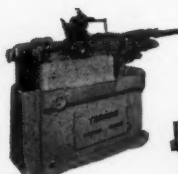
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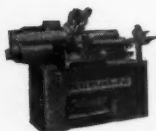
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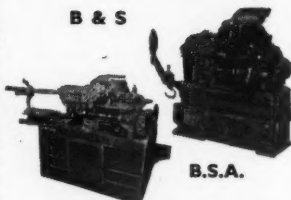
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- Machines are rebuilt to original specification of accuracy and limits.
- All parts fitted are interchangeable with maker's spares.
- Reconditioning not only costs less than a new machine but can also be charged wholly as a maintenance expense ranking for full tax relief.
- We can loan a machine equivalent to the one taken out thereby assuring customer of his continuity of production.

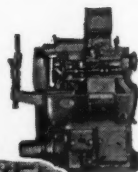
MELBOURNE ENGINEERING CO. LTD., MELBOURNE, Near DERBY
(H. E. SLAWSON, M.B.E., M.I.P.E., Man. Director) Tel: MELBOURNE 232

B & S



B.S.A.

C.V.A.



INDEX



★ May we visit your works
and quote for recondition-
ing your machine?

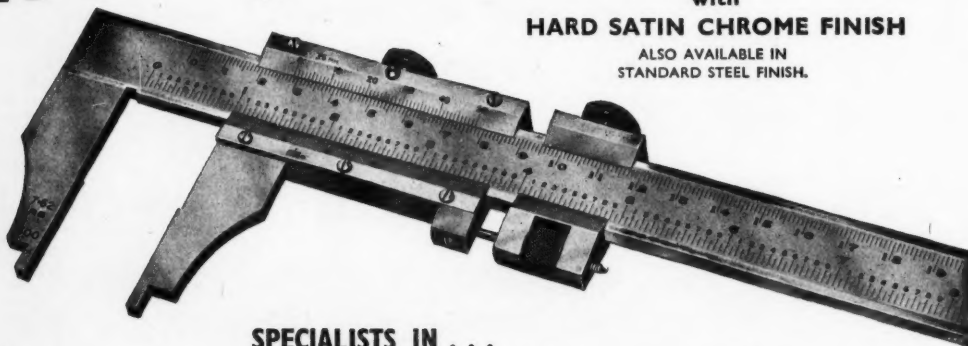
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Regd.

PRECISION VERNIER CALLIPERS

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HARD SATIN CHROME FINISH

ALSO AVAILABLE IN
STANDARD STEEL FINISH.



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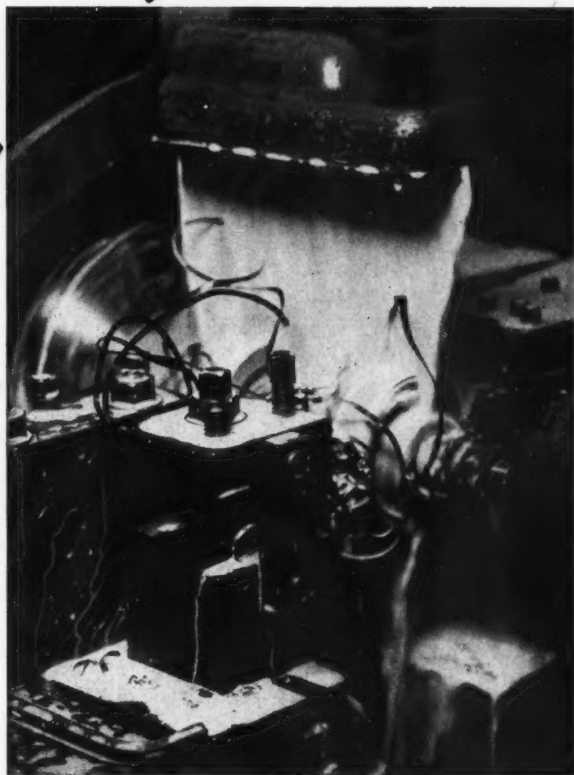
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flushing regularly with hot

Solvex SOLUTION
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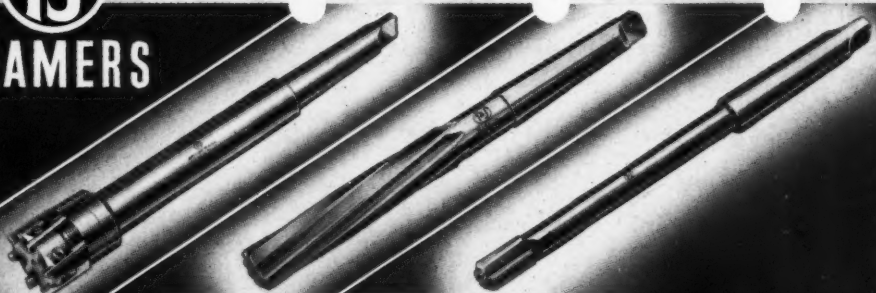


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**ADJUSTABLE SOLID
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**SOLID
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the REAL POINT is that the

**HUNT DRILL GRINDER
*gives a perfect point***



... and the perfect point gives

- LONGER DRILL LIFE
- MORE ACCURATE HOLES
- FASTER RATES OF PENETRATION

Ask for complete details

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**Peak performance
under
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**produce the form that passes inspection
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Ensure greater productivity by eliminating frequent resetting!

CEJ Dies are made from the finest steels — either Carbon Chrome or 18/4/1 High Speed. They are heat treated under rigid control, and then thread ground to close tolerances.

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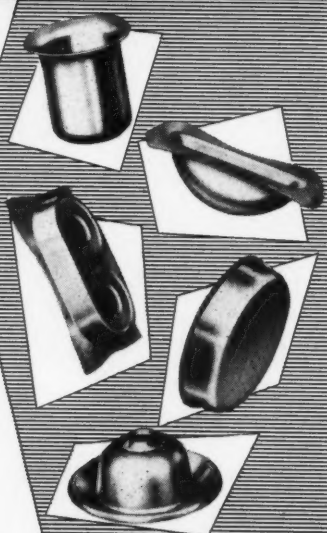
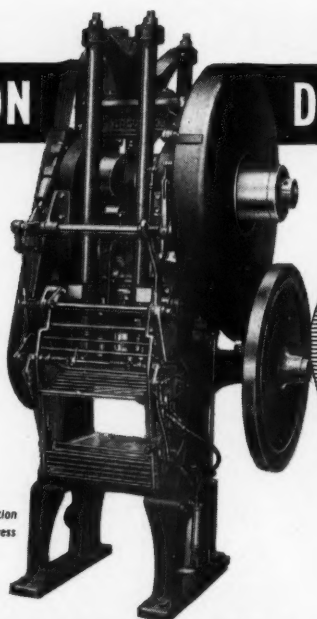
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Power Screw Presses
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Single and Double
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Size 3½ Double Action
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**HIGH PERFORMANCE
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WESTON

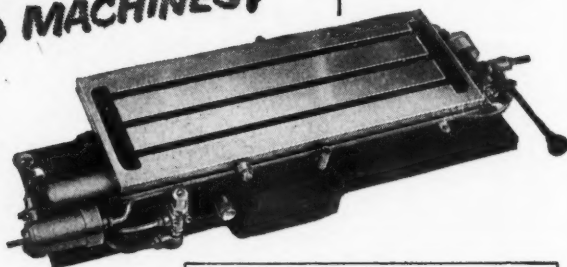
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PRODUCTION UNITS
& WORK TRANSFER UNITS**
for Fast Approach and Return Speeds
... at a very sensible price.

3 STANDARD MODELS AVAILABLE

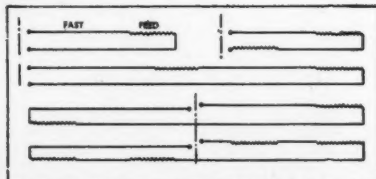
	Model 0	Model 1	Model 2	GIVES HIGHER PRODUCTION ON MILLING, DRILLING, TAPPING AND BORING MACHINES
Travel ...	0"-5"	0"-6"	0"-12"	
Work Table ...	12" x 4½"	18" x 6½"	26" x 9½"	
Approx. thrust	180 lb.	400 lb.	800 lb.	

Recommended air line pressure: 70/100 lb. per sq. in.

Feed rates are infinitely variable from 1 in. per min. upwards on 0 and 1 Models, and ¼ in. per min. on Model 2. Special tables with feed rates down to ¼ in. per min. are made for heavier work. The production Unit cylinder is cushioned on return stroke. Work Transfer Units have cushioned cylinders working against adjustable dead stops, stationing one component under the tool whilst another is being loaded.



• Other movements made to customers' requirements.



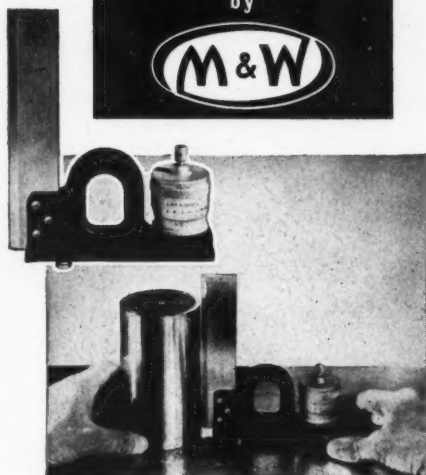
Diagrammatic illustration showing some of the many cycles available.

THE WESTON MACHINE TOOL CO., LTD

210 BRACEBRIDGE STREET, ASTON, BIRMINGHAM 6. Tel: ASTon Cross 1788

NEW TOOLS

by



ADJUSTABLE SQUARE

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CENTRE SQUARE

An inexpensive tool for rapidly finding the centre of the face of round bars or discs. Two sizes.

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MOORE & WRIGHT (SHEFFIELD) LTD.
HANDSWORTH ROAD, SHEFFIELD 13.

MHW 50

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... are you still losing time and money by repairing screw threads in the old-fashioned way?

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HELI-COIL

screw thread
repair kits



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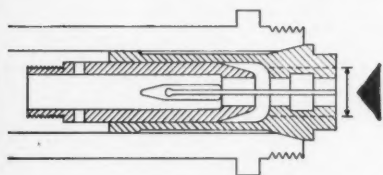
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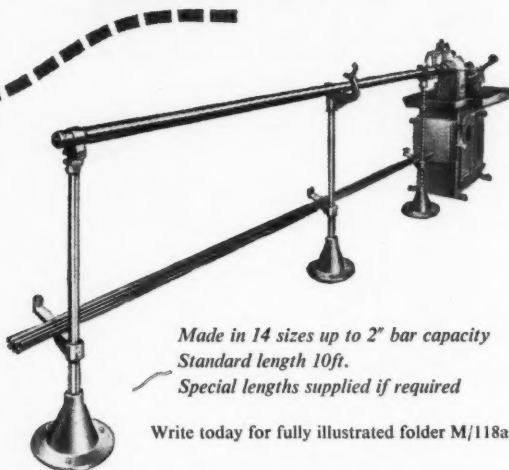
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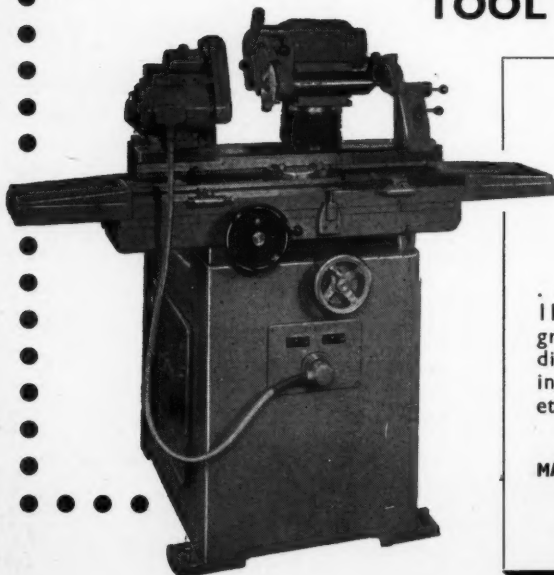


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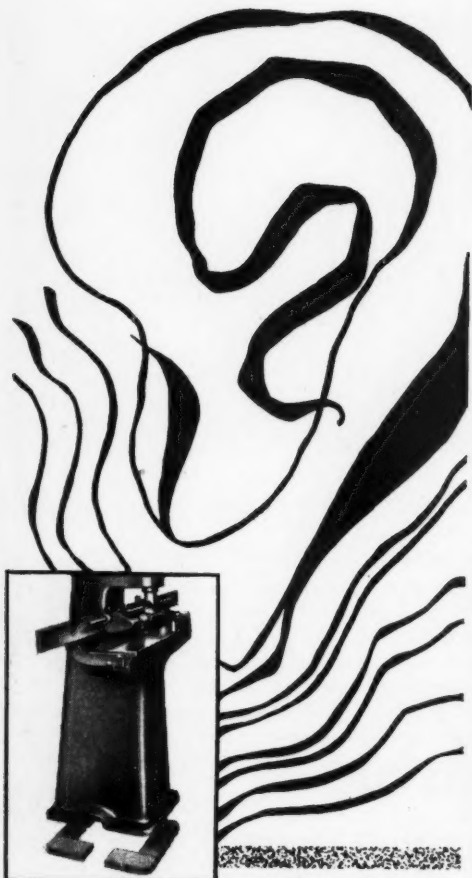
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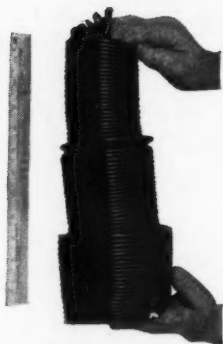
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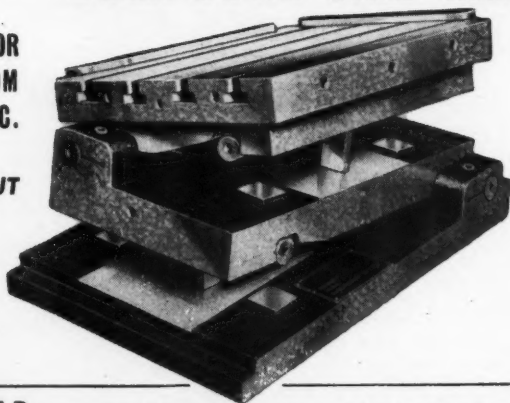
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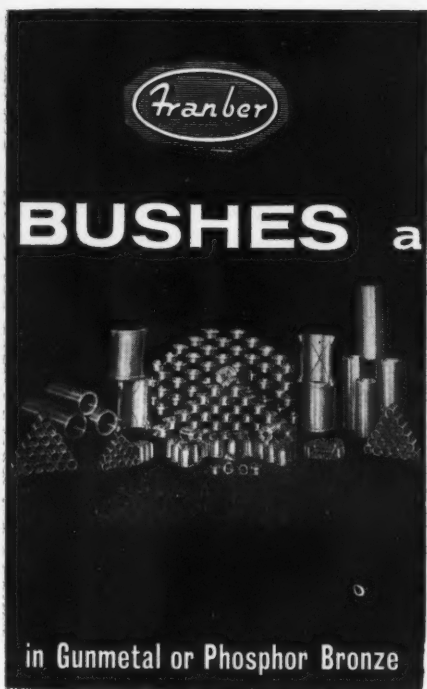
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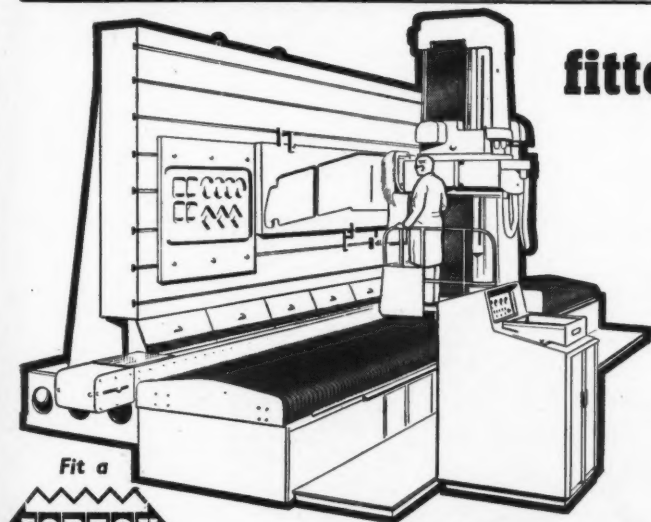
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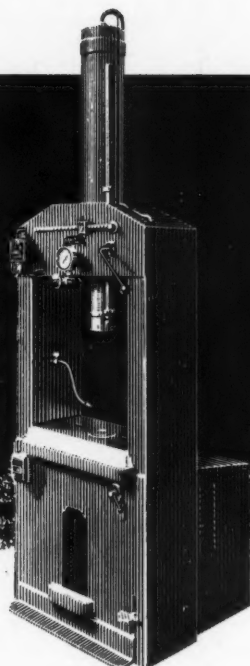
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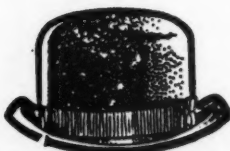
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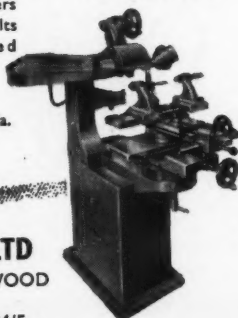
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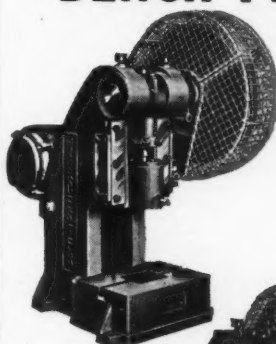
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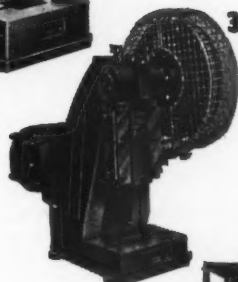
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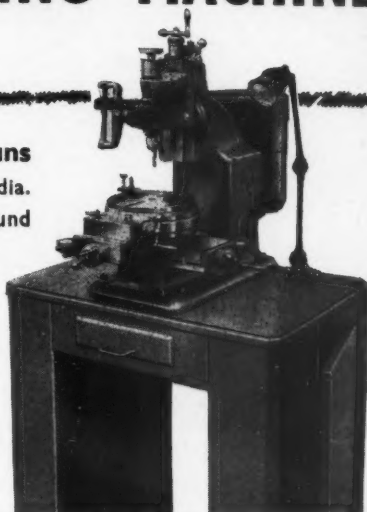
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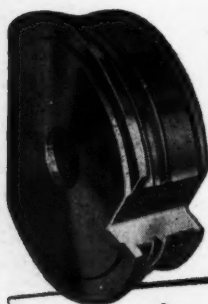
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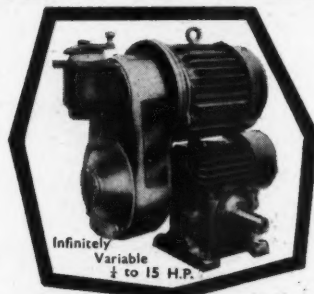


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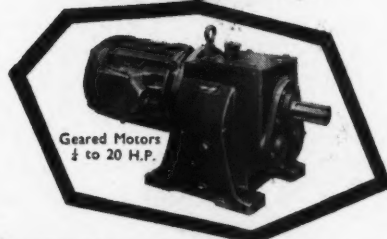
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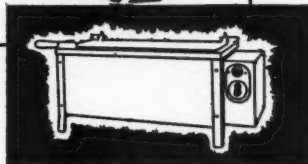
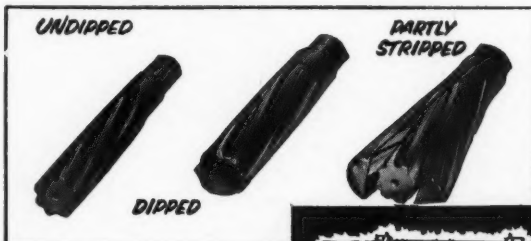
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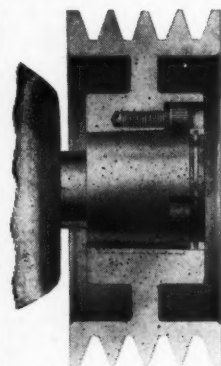
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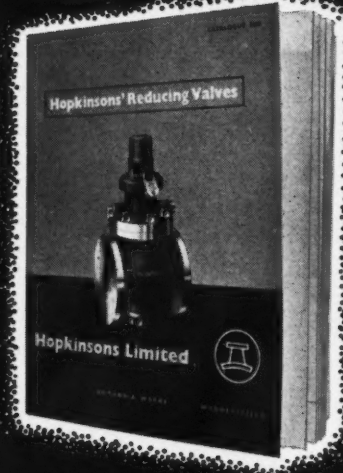


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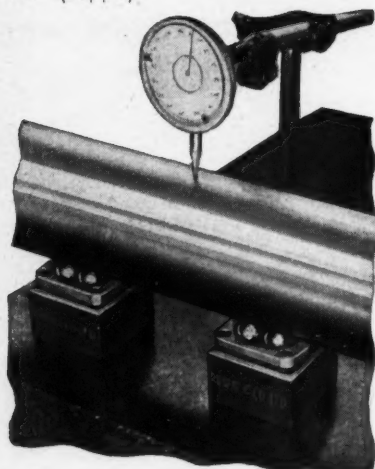
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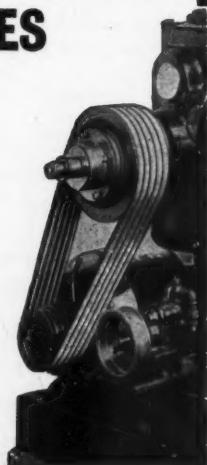
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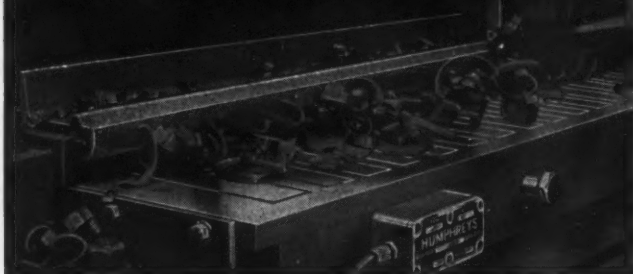
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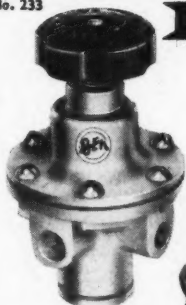


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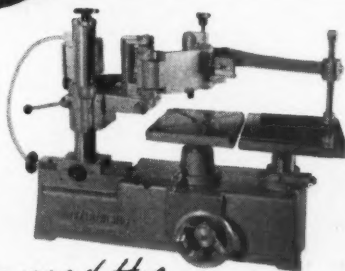
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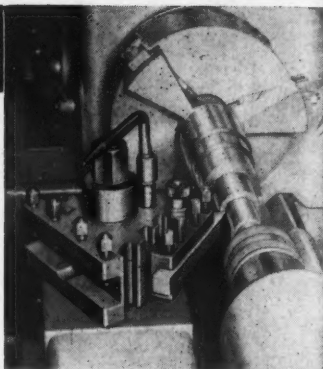
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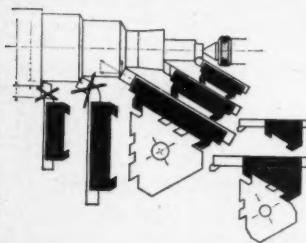
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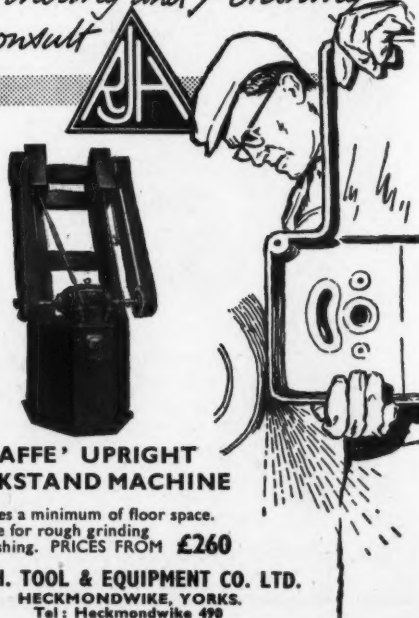
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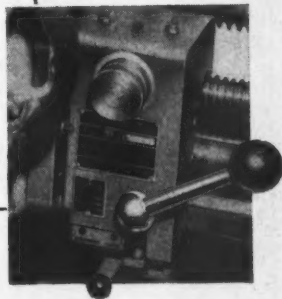


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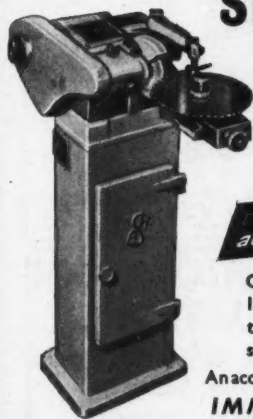
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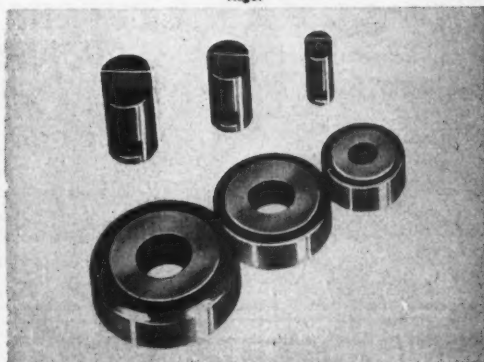
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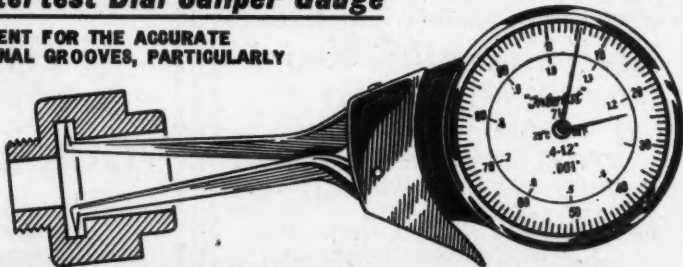
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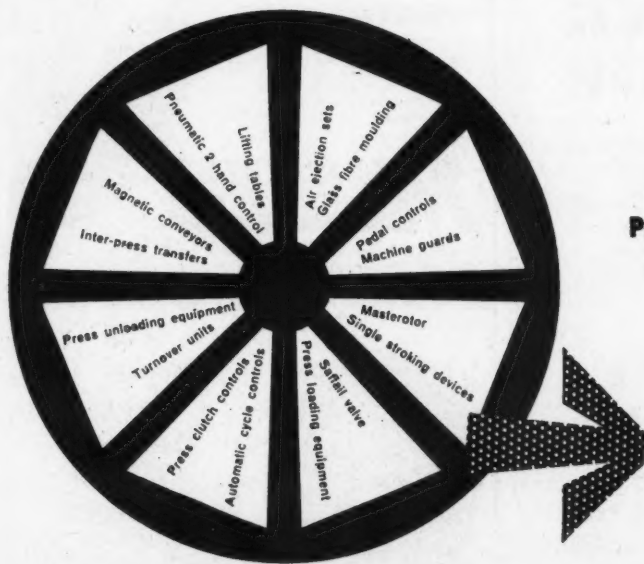


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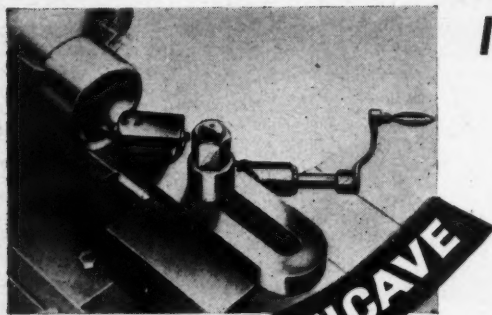
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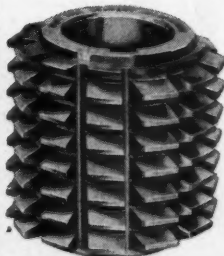
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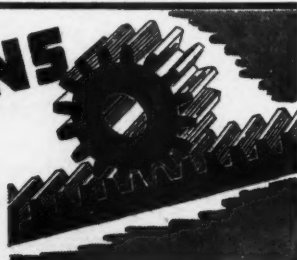
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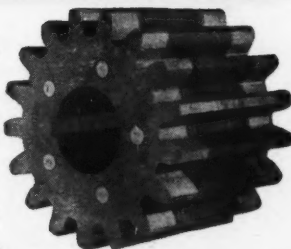
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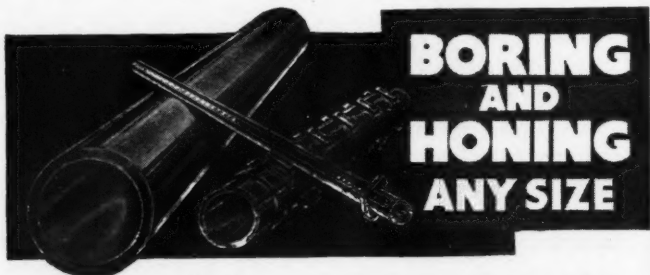
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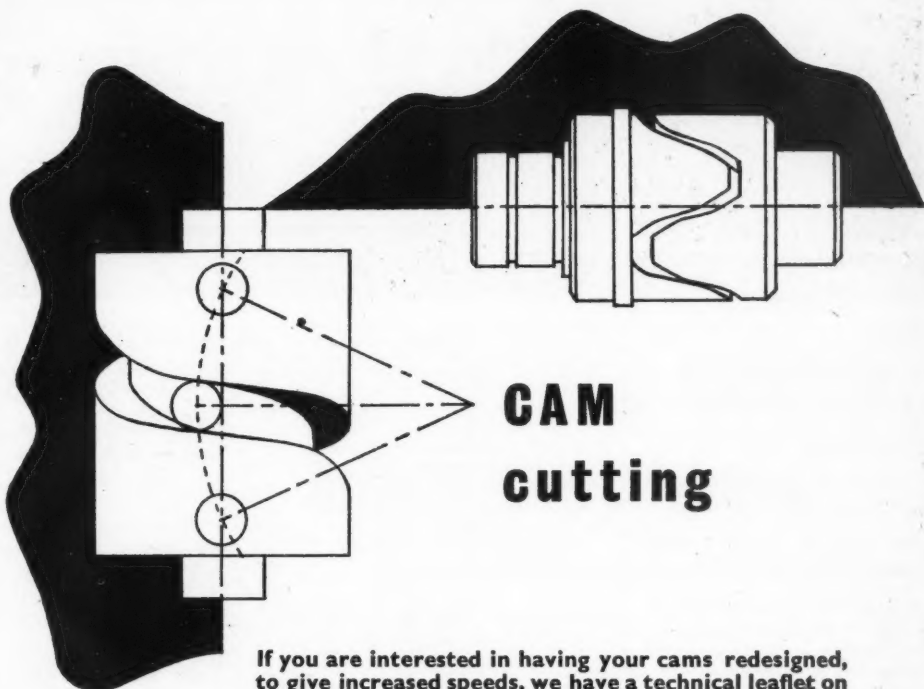
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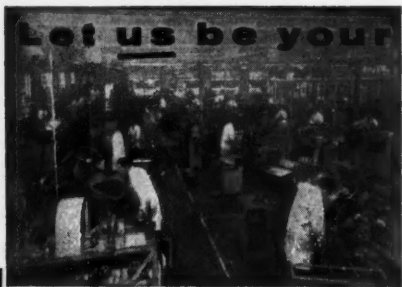


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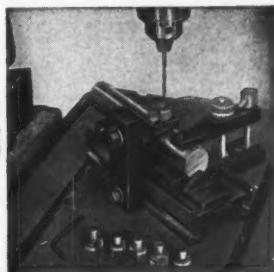
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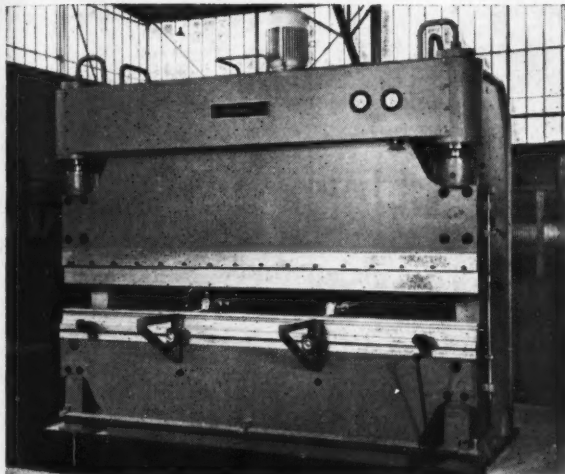
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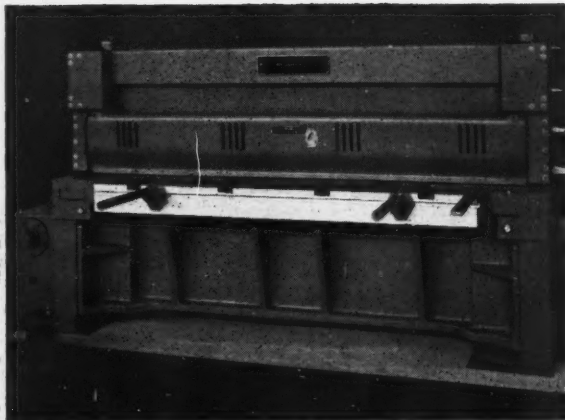


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Blade length	126 in.
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359 Euston Road, London, N.W.1

EUSTON 5900

41 Water Street, Birmingham 3

CENTRAL 7606

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Telephone: Central 2287
Telegrams: Acfibr Cent. London

AVAILABLE FROM STOCK

All machines listed below are at our Works in Sutherland Walk, Walworth Road, S.E.17

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New GRAFFENSTADEN AF075 Horizontal Borer. 3in. spindle. 17 $\frac{1}{2}$ in. faceplate.

BROACH

FORST RIAS Universal Vertical Broach for internal and surface broaching. 5 tons, 39 $\frac{1}{2}$ in. stroke. 1952 machine.

RADIAL DRILLS

New VOEST Swivel Head Radial, 1in. capacity, 3ft. 3in. radius.
CERUTI Type TNC60 5ft. 8in. Heavy Duty Radial. 1952 machine.

GRINDERS

BROWN & SHARPE No. 2 Surface, GRAND RAPIDS 18in. x 6in. and 24in. x 10in. Hydraulic Surface Grinders.
MOPCO 39in. x 11in. Hydraulic Surface Grinder, with inclinable spindle for horizontal or vertical grinding.
CHURCHILL 10in. x 24in. Universal.
LANDIS 12 x 48 Universal.
BROWN & SHARPE No. 3 Universal.
MORTON 14in. x 36in. Universal.
ROWLAND Three Wheel Carbide Tool Grinder and Lapper.
NEWALL 10U Universal Lapper.

CAPSTAN AND TURRET LATHES

GISHALT 1L Turret Lathe.
FOSTER No. 28 Turret Lathe.

CENTRE LATHES

WARD, HAGGAS & SMITH 8 $\frac{1}{2}$ in. Gap Bed. 36in. between centres.
CROMWELL 3 $\frac{1}{2}$ in. Precision.

MILLERS

SUNDSTRAND No. 0 Rigidmill.
OLIVETTI FP2 Kneeless Production, 39 $\frac{1}{2}$ in. table travel.
New GRAFFENSTADEN FU073 Universal, table 49 $\frac{1}{2}$ in. x 10 $\frac{1}{2}$ in.
GRAFFENSTADEN FH121 Plain Horizontal with Universal Vertical Head. Table size 59in. x 13 $\frac{1}{2}$ in.
HERBERT 23V Vert. Table 68in. x 17in. 48in. traverse.
REED PRENTICE No. 6 Heavy Duty Vert. Table 84in. x 20in. 72in. traverse.
HOLROYD T117 Thread Miller.
HELLER Automatic Thread Millers (4).
MOREY 12M Duplex Profiler.
ASQUITH HKO Duplex Keyseater.

PRESS

V & O No. 11 Double Action. Approx. 10 tons. Roll feed. Max. draw 1in.

All machines motorised 400/3/50 unless otherwise stated.

Edgwick Vertical Keyseating

Machine. 4 $\frac{1}{2}$ in. stroke, throat 8 $\frac{1}{2}$ in., max. daylight 15in. to 3in. Table 32in. x 9in. 8 $\frac{1}{2}$ in. cross slide traverse. 16in. table traverse. 6 spindle speeds, collet holders and collets. 1 $\frac{1}{2}$ h.p. motor, 440-440/3/50. 690-1,440 r.p.m. Switchgear complete.—BOX C561, MACHINERY, Clifton House, Euston Road, N.W.1.

Huller UG3 Pedestal Tapper

4in. cap. in steel. Controlled pitch. 3 speeds. Mot.—WILCOX & CO., Barr Street, Birmingham, 19. Northern 1234/5.



HAVE AVAILABLE FOR EARLY DELIVERY

One NEWALL 2436 Jig Borer, fully rebuilt and carrying maker's guarantees.

One NEWALL No. 0 Jig Borer, fully rebuilt and carrying maker's guarantees.

Capacity: 18in. by 12in. Table 14in. Spindle Nose to top of table

One NEWALL 'L1' Internal Grinding Machine, 10in. by 24in. fully rebuilt and carrying maker's guarantees. Maximum Grinding Depth: 12in.

One NEWALL No. 1 Jig Borer, fully rebuilt and carrying maker's guarantees.

One NEWALL No. 2 Jig Borer, fully rebuilt and carrying maker's guarantees.

THE NEWALL USED MACHINE DIVISION OUNDFLE ROAD. ORTON LONGUEVILLE PETERBOROUGH

Telephone: Peterborough 67116/7

Lang Heavy Duty Boring and

Facing Lathe, 14in. swing x 54in. between centres. Speeds 19 to 900 r.p.m. Feeds 36 to 432 c.p.i. Hole in spindle 1 $\frac{1}{2}$ in. dia. £200 ex works. O.N.O. London area.—BOX C575, MACHINERY, Clifton House, Euston Road, N.W.1.

SEDGWICKS type C.10 Q.L. 10ft. x 1 $\frac{1}{2}$ in. Universal Bending and Folding Machine. Motorised 415 volts, 3 phase, 50 cycles. with control gear.

EDWARDS 4ft. x 14g. Power Guillotine, 415 volts, 3 phase, 50 cycles.

R.O. Gray

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London, N.W.10

Telephone: ELGar 4841/4842

LEITCHWORTH URBAN DISTRICT COUNCIL Sale of Lathe

Tenders are invited for the purchase of a Willson Centre Lathe, 4ft. 6in. between centres, 7 $\frac{1}{2}$ in. swing. Details may be obtained from Engineer and Surveyor, Town Hall, Leitchworth. Inspection at the Council's Sewage Works, Stotfold Road, Leitchworth, by appointment; tel.: Leitchworth 208.

Purchaser to dismantle and transport the machine from site.

Offers to be made in writing to the Engineer and Surveyor in envelope endorsed "Lathe," not later than 10th March, 1961.

H. PLINSTON, L.L.B.
Clerk to the Council.

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Now available
HORIZONTAL
TAPPING MACHINES
Capacities $\frac{7}{8}$ in. $\frac{1}{2}$ in. $\frac{1}{4}$ in.

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MACHINE TOOLS CO
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Grinding Machine. Hydraulic traverse 48in. Segmented wheel. Excellent condition.—BOX C717, MACHINERY, Clifton House, Euston Road, N.W.1.

Richards Vertical Boring Mill.

with two Swivel Rams, 7ft. diameter. Table, Heavy Duty Machine. Motorised and complete with Starter. Old Machine in first class condition.—BOX C686, MACHINERY, Clifton House, Euston Road, N.W.1.

Draw Bench For Sale. Motor-

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FOR SALE

HERBERT No. 7 JUNIOR Combination Turret Lathe; bar capacity, 2 $\frac{1}{2}$ in.; Flamard covered bed; height of centres, 8 $\frac{1}{2}$ in.; hexagon turret with 2 $\frac{1}{2}$ in. dia. holes; power feed to turret; power cross and longitudinal feed to saddle; arranged for screw-cutting; 8 rates spindle speed, 30 to 750 r.p.m.; complete with overhead pilot bar, dead length collet chuck and bar feed, 18 sets collet pads, four-way toolpost, rear toolpost, taper turning attachment, 3 leaders and nuts, 6 plain toolholders, 2 knee turning toolholders, suds pump and piping; 400/3/50 motor drive.

Excellent condition.

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WIDDOWSONS

WARD No. 13

COMBINATION TURRET LATHE

Covered Bed, 25in. Concentric Chuck, 27in. 4-Jaw Independent Chuck, Good Turret, Tooling Taper Turning Attachment, 35-h.p. Motor, 400/3/50.

MODERN MACHINE — EXCELLENT CONDITION

PEARNS-RICHARDS PRT2N HORIZONTAL BORING and FACING MACHINE

3in. Traversing Spindle. Chain Drive to Head. Coolant Fittings. 400/3/50.

SCARCELY USED

CINCINNATI HYDROMATIC 56-72

PLAIN HORIZONTAL

PRODUCTION MILLING MACHINE

Table size 103in. by 26in., Spindle speeds 24 to 179 r.p.m. Coolant pump and fittings, etc. 400/3/50.

EXCELLENT CONDITION

REINECKER 10 ft.

AUTOMATIC GEAR SHAPING MACHINE

For Internal and External Spur Gears, Face width 7in. Max. Pitch 1 D.P.

MODERN MACHINE — EXCELLENT CONDITION

HERBERT WIDDOWSON & SONS LIMITED

Canal Street Works, Nottingham • Telephone: 51891 (4 lines)

MEMBER OF B.A.M.T.M.

HERBERT No. 48 Capstan Lathe, with bar feed, 415/3/50.

DRUMMOND Model K Capstan Lathe, arranged for chucking, 415/3/50.

GISHOLT No. 4 Capstan Lathe, arranged for chucking, 415/3/50.

R.D. Gray

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London, N.W.10

Telephone: ELGar 4841/4842

English Electric 35 kVA Induction Heater transformer, condensers, control gear and meters, all self-contained in cabinet; suitable for multi-soldering, brazing and hardening work in external jigs. Purchased 18 months ago, with special coils at £3,600; only used occasional development work. Nearest to £2,500 considered.—E. J. P.M. 71, Leatherhead Road, Chessington, Surrey. Epsom 4992.

No. 2 Wickman Horstman Thread Grinding Machine. Form relieving. Fully motorised.—BOX C738, MACHINERY, Clifton House, Euston Road, N.W.1.

New 6ft. 0in. × 3ft. 6in.; 7ft. 0in. × 4ft. 0in.; and 10ft. 0in. × 3ft. 0in. Marking Off Tables for sale. Accurately machined top face and heavily ribbed. Mounted on cast iron legs. Total height approx. 34in.—Illustrations and full details from F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

Brown & Sharpe Omniversal No. 0 Toolroom Milling Machine, in AS NEW condition.—BOX C728, MACHINERY, Clifton House, Euston Road, N.W.1.

Swift Sentinel Lathe. Type 10SP 20in. swing. × 6ft. between centres. Excellent condition.—BOX C673, MACHINERY, Clifton House, Euston Road, N.W.1.

Herbert Flash Tapper. Motor-ised 400/3/50. No. 28 in first class condition.—BOX C643, MACHINERY, Clifton House, Euston Road, N.W.1.

A Good Number of High-class Machine Tools always in stock.—M. ELLISON (SALFORD), LTD., Cook Street, off Chapel Street, Salford, 3, Lancs.

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GRANOR OF HALIFAX 28in. stroke Heavy Duty Shaping Machine. 400-440/3/50.

EARLY DELIVERY

MITCHELL OF KEIGHLEY 8in. Type DMS Gap Bed Lathe, by 5ft. 3in. B.C. 400-440/3/50. Instant delivery.

MITCHELL OF KEIGHLEY 10in. Type DM10 Gap Bed Lathe by 5ft. 5in. between centres. 400-440/3/50. Instant delivery.

MITCHELL OF KEIGHLEY 12in. Type DM12 Gap Bed Lathe by 6ft. 9in. B.C. 400-440/3/50. April delivery.

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VICTORIA No. V2 Vertical Milling Machine. Table size 45in. × 11in. 400-440/3/50. Instant delivery.

CENTAUR TOOL WORKS,
EYRE STREET, SPRING HILL,
BIRMINGHAM, 18

Tel.: EDGhaston 1118 & 1119. Capstan, Birmingham

Churchill Hydraulic Universal Grinder. Model P.A.H. Internal and External. Capacity 10in. × 24in. Motorised.—WILCOX & CO., Barr Street, Birmingham, 19, Northern 1234/5.

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VICTORIA P2 Horizontal Mill, table 45in. × 11in. 1950 machine in first class condition.

SOMUA Horizontal Milling Machine, table 67in. × 14in., spindle speeds 32 to 1,250 r.p.m. No. 50 I.T. 18 feeds $\frac{1}{16}$ in. to $\frac{1}{4}$ in. per min., power feeds and rapid traverse in all directions. 1952 machine.

LE BLOND Lathe, 18in. swing × 9ft. between. A.G.H. S.S. & S.C. Speeds 15 to 522, double vee straight bed.

CINCINNATI Plain Hydromatic Mill 3/36, speeds 27 to 200 r.p.m., power rapid traverse with auto cycle.

ASQUITH OD1 4ft. 6in. Radial Drill, 12 speeds 58 to 1,550 r.p.m. No. 5 M.T., 2 motors, power rise and fall, power feed spindle, loose box table.

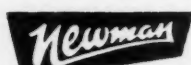
All machines motorised 415/3/50.

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AUTOMATICS
POTTER & JOHNSON Model 5D Chucking Automatic.
BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES
KEARNS No. 2 Horizontal Boring and Facing Machine, 3in. dia. travelling spindle (1959).
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type FIT Horizontal Floor Boring Machine, 34in. travelling spindle, 28in. diameter facing head.
GIDDINGS & LEWIS No. 45 Horizontal Boring Machine, 5in. diameter travelling spindle.

CAPSTAN AND CENTRE LATHES
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 104in. centre height.
WARD TB Combination Turret Lathe.
HERBERT No. 12 Combination Turret Lathe, 64in. diameter hollow spindle.
NILES Heavy Duty Centre Lathe, S.S. & S.C., 17in. centre height x 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height x 30in. between centres.

DRILLING MACHINES
HETTNER Radial Drilling Machine, 10ft. elevating arm.
TOWN Radial Drilling Machine, 4ft. 6in. elevating arm. (NEW.)
TOWN 30in. Single Spindle Boring and Drilling Machine.

GEAR MACHINES
OROUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES
LANDIS Plain Hydraulic Cylindrical Grinding Machine, 18in. swing x 72in. between centres.
OROUTT Model HM24 Internal Spur Gear Grinding Machine.
CHURCHILL Crankshaft Grinding Machine, 26in. swing x 84in. between centres.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing x 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing x 36in. between centres.
B.S.A. LANDIS Plain Cylindrical Grinding Machine, 6in. swing x 30in. between centres.

MILLING MACHINES
CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 94in. x 22in. (1952).
CINCINNATI 1/18 Automatic Manufacturing Milling Machine.
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. x 10in.
CINCINNATI No. 1M Vertical Milling Machine.
CINCINNATI No. 4 Dial Type Horizontal Milling Machine.
GRAFFENSTADEN Model F1101 Plain Horizontal Milling Machine, table 52in. x 10in.
TECHNOMEX Universal Horizontal Milling Machine, table 59in. x 16in. (NEW.)
PRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3E Automatic Production Milling Machine, table 25in. x 18in.

PLANING MACHINE
SUMMERSKILL Double Column Planing Machine; capacity 16ft. x 5ft. x 5ft. Four toolboxes.

MISCELLANEOUS
RUSSEL Model 26/28 Hydroflood Cold Sawing Machine.
LANGE & GALEN 28in. stroke Double Headed hydraulic Shaping Machine.
TAYLOR & CHALLEN Double Sided 50-ton Geared Power Press, 10in. stroke.

NEWMAN INDUSTRIES LIMITED,

Machine Tool Division: YATE, BRISTOL
 Tel.: Chipping Sodbury 3911. Telex. 44121.
 Cables: "Dynauno Yate."
 London Office: Terminal House, Grosvenor Gardens, S.W.1. Tel.: Sloane 8206.
 Telex 23280.

Worthington Simpson 2-stage
 Air Compressor. Air cooled, size 100. Brooks Motor 21 h.p. 400-440/3/50. Syn. speed 1,000 r.p.m. and Receiver—BOX 5587, MACHINERY, Clifton House, Euston Road, N.W.1.

Loewe Boring and Facing Lathe,
 high speed machine, 475 to 3,000 r.p.m. Swing 16in. Multi-speed motor, 400/3/50.—BOX C606, MACHINERY, Clifton House, Euston Road, N.W.1.

Jones & Shipman Hydraulic
 Precision Universal Grinder, size 12in. x 36in. with standard equipment and internal spindle. Excellent condition.—BOX C822, MACHINERY, Clifton House, Euston Road, N.W.1.



No. 2 **WARNER & SWASEY** Chucking Capstan.
 No. 3 **GISHOLT** Chucking Capstan, some bar feed equipment.
 2D **HERBERT** Bar Feed Capstan Lathe.
 25S **HERBERT** Bar Feed Capstan Lathe.
 No. 7 **WARD** Bar Feed Capstan Lathe, covered bed.

4ft. **ASQUITH** Universal Drill. Portable.
 6ft. x 7in. **BENNIE** Guillotine. Heavy Duty.
 84in. **LANG** S.S. & S.C. Lathe, 4ft. between centres.

3in. x 10in. **FRITZ WERNER** Plain Miller.
 New 7in. **WOODHOUSE & MITCHELL** Type 70 Junior Lathe.

60in. **JACKSON & BRADWELL** Balancing Machine.
 20in. **ARCHDALE** Plain Milling Machine. Power feeds and rapids.

4in. **HERBERT** Pedestal Drill.
 6in. **HOLBROOK** Toolroom Lathe.
 15in. S.S. & S.C. Heavy Duty **OLDFIELD & SCHOFIELD** Lathe. Bed 12ft. 6in. Spindle speeds 65-332 r.p.m. Screwcutting speeds 14-22 threads.

14in. **BUTLER** Slotting Machine. Circular table.
 84in. **FABIUS** Lathe, 5ft. between centres. (New.)

Model HBY **CHURCHILL** Internal Grinder.
 No. 3 **KITCHEN & WADE** Vertical Honer.
 No. 2 **DRUMMOND** Marcuit Gear Cutter.
 27in. **WOTAN** Hydraulic Shaper.

16in. **BLANCHARD** Rotary Surface Grinder.
 New **PASQUINO** Vertical Mill. Swivel head, power feeds and rapids.
 New 354in. **ZERBST** Lathe, 10ft. 4in. between centres.

New 10in. x 40in. **MIKROMAT** Hydraulic Surface Grinder.

24in. x 36in. **BULLARD** Vertical Boreers.
 No. 2 **WARNER & SWASEY** Chucking Capstan.

24in. x 8in. **ABRASIVE** Model 3B Surface Grinder, with magnetic chuck. As new.
 New **LAGUN** 49in. x 12in. Universal Miller, with dividing heads and universal attachment. Power feeds and rapids in all directions. £1,250.

DIMCO (Gt. Britain) LTD.

28 Wood Lane,
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 SHEPHERD'S Bush 4401/2.

American Toolworks Centre
 Lathe, 19in. Swing, 30in. between Centres. Spindle speeds 17-600 r.p.m. Excellent condition.

Further details from:—
 C. & G. OLDFIELD, LTD.,
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 PAISLEY.

28in. **ARCHDALE** Plain Horizontal Milling Machine, 415/3/50. Table w.s. 49in. x 10in.
EDGWICK Plain Horizontal Milling Machine, 415/3/50. Table w.s. 26in. x 7in.
TRIDENT Model V.O. Swivel Head Vertical Milling Machine, 415/3/50. Table w.s. 30in. x 8in.
ASQUITH Twin Spindle Profile Milling Machine, 415/3/50. Table w.s. 18in. x 15in.

R. J. Gray

4/6, Minerva Road, Park Royal,
 London, N.W.10
 Telephone: ELGar 4841/4842

JACKSON & BRADWELL ELECTRONIC DYNAMIC BALANCING MACHINE (MODEL 140E)

For Full Particulars apply:—
MR. L. WILSON,
EX-CELL-O CORPORATION (Machine Tools) LTD.
HASTINGS ROAD, LEICESTER

W. 8969 Brayshaw Two-stage
 High Speed Steel Furnace. REF. CA/3. New. Any reasonable offer accepted.—DUCK, 6a, Broad Street, Teddington, Middlesex.

Delapena Induction Heating

Units. With generators, 2 and 6 kVA. For hardening, brazing, etc.—WILCOX & CO., Barr Street, Birmingham, 19. Northern 1234/5.

Two Edwin Mills 4-Column

Hydraulic Presses for sale. Pressure 11 tons, daylight 16in.; Platens 15in. x 15in. Will sell separately.—Photo and full details from F. J. EDWARDS, LTD., 359, Euston Road, London, N.W.1. EUSTON 5000.

HIGH QUALITY USED MACHINE TOOLS

ARCHDALE 20in. Milling Machine, table size 40in. x 10in., power and rapid traverses to table, reversing spindle, backlash eliminator. 400/3/50.

COVMAC 18in. Swing Gap Bed Lathe, by 3ft. 3in. b.c. 400/3/50.

COVMAC 17in. Swing Gap Bed Lathe, by 5ft. 0in. b.c. 400/3/50.

DENHAM 6in. Gap Bed Lathe by 2ft. 3in. b.c. 400/3/50.

GRANOF OF HALIFAX 18in. x 28ft. b.c. A.G.H. Gap Bed S.S. & S.C. Lathe. 400/3/50.

D.S. & G. 7in. CH by 4ft. 0in. b.c. Straight Bed Lathe. 400/3/50.

BARDONS & OLIVER No. 3 Universal Turret Lathe. 400/3/50.

WARNER & SWASEY 1A Turret Lathe. 400/3/50.

KELLY 28in. Stroke Heavy Duty Shaping Machine with swivelling table. 400/3/50.

RUSSELL Saw Sharpening Machine, max. capacity 42in. diameter. 400/3/50.

ORMEROD 12in. Slotting Machine. 400/3/50.

WE UNDERTAKE REBUILDING OF ALL TYPES OF MACHINE TOOLS

CENTAUR TOOL WORKS, EYRE STREET, SPRING HILL, BIRMINGHAM, 18

Tel. EDghaston 1118 & 1119 'Grams Capstan, Birmingham

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No. 336 Hydromatic in first class condition. Motorised 400/3/50

Price £475

K & C MACHINERY LTD.

Stephen Street, Coventry

Telephone: Coventry 23669

No. 3 Drummond-Maxicut Automatic Gear Shaper. Capacity 18in. dia. x 5in. feed. 4/5 D.P.—LEE & HUNT, Ltd., Crocus Street, Nottingham. Phone: 84246.

HARVEY (S.M.T.C.) Heavy Duty Lathe, S.S. & S.C. 18in. centres by 9ft. 6in. b.c. 29in. swing over saddle. Ball and roller bearing spindle. 12 speeds 8-6/225 r.p.m. Rapid traverse to saddle, 32in. chuck, 15 H.P. motor 400/3/50. £2,250.

BOX C.708, MACHINERY, Clifton House, Euston Road, N.W.1

AUTOS
CONOMATIC 14in. 8 spindle. Type W.W.
BORING
KEARNS No. 2 Boring and Facing.
DRILLING
ASQUITH 4ft. 6in. O.D.1 Radial Drill.
PROGRESS 5E. Round table.
GRINDING
LANDIS 12 x 48 Universal Grinder.
CHURCHILL 8 x 36in. Plain. Hydraulic bearings.
LATHES
WARNER & SWASEY No. 2A Long bed. SOUTHBEND 16in.
EDGEMORE 7in.
DEAN, SMITH & GRACE. Height of centres 7in.
WARNER & SWASEY No. 5 Proselector.

MILLING
20in. **ABCHDALE** Plain Mill. Rapid.
18in. **EDGEMORE** Production Mill
MILWAUKEE 2E Plain.
SHAPING
24in. **CHURCHILL REDMAN** Heavy Duty.
19in. **TOWN** Heavy Duty.

SHEET METAL
GUILLOTINES
EDWARDS 6ft. x 4in. Overcrank.
EDWARDS 6ft. x 4in. Overcrank.
FOLDERS
MORGAN 6ft. x 14g. Universal.
EDWARDS 6ft. x 14g. Swing beam, hand geared.
EDWARDS 6ft. x 14g. Open ended.
EDWARDS 6ft. x 16g. Open ended.

"ELDAIR" NEW PRESS BRAKES
6ft. x 12g. between column. Delivery 10 weeks.
6ft. x 14in. between column. Delivery 8 weeks.
10ft. x 14in. between column. Delivery 1 week.

All machines motorised 400/3/50 cycles.

STANCROFT LTD.

BEDWORTH ROAD, COVENTRY.

Telephone: Coventry 88072/3.

Harry Kirk

can recommend the following modern quality machines from STOCK

AUTOMATICS

BULLARD 8in. Mult-au-Matic, 6 spindles, type D.

RYDER Verticalauto, capacity 16in. swing x 8in., 6 spindles.

BORING MACHINES

WEBSTER & BENNET 36in. Vertical Borer.
RICHARDS 36in. Vertical Boring Mill complete with side head.

JONES 6in. Spindle Horizontal Borer. Table 17ft. 6in. x 8ft. Spindle travel 48in. Rapid traverse 84in. per min. Motorised 400/3/50. Weight 70 tons.

SCHARMANN 3in. Sliding Spindle Horizontal Boring Machine, equipped with facing head and screwcutting.

BULLARD 36in. Vertical Boring Mill.

KITCHEN & WADE Vertical Fine Boring Machine. 14in. stroke. Compound table.

SCHIESS Vertical Boring Mill, 39in. dia. of table. Maximum swing 48in. S.C.M.D. 35 h.p., 400/3/50.

GRINDING MACHINES

HEALD No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.

BILLETTER Hydraulic Open-side Slideaway Grinding Machine, capacity 47in. x 12in.

LATHES

NOBLE & LUND Heavy Duty Centre Lathe, 22in. centre height x 29ft. between centres. Max. swing over saddle 33in. dia.

HARVEY Heavy Duty Centre Lathe, 42in. centre height x 52ft. between centres. Max. swing over saddles 65in. dia.

CHURCHILL-REDMAN S.S. & S.C. Centre Lathe, 7in. centre height x 4ft. 6in. between centres.

DENHAM S.S. & S.C. Gap Bed Centre Lathe, 15in. centre height x 12ft. 6in. between centres. Swing 54in. in gap, complete with Taper Turning Attachment. Face-plate, Chucks, etc.

CRAVEN S.S. & S.C. Centre Lathe, 13in. centre height x 65ft. between centres.

CRAVEN S.S. & S.C. Centre Lathe, 13in. centre height x 31ft. 6in. between centres.

WERMELINGER Centre Lathe. Model M.J8. 6in. centre height x 32in. between centres.

HERBERT No. 11 Combination Turret Lathe.

MILLING MACHINES

BROWN & SHARPE No. 3 Vertical Milling Machine.

ARCHDALE 30in. Vertical Milling Machine.

COLLET & ENGLEHARDT Keller Type Die Sinking Machine. Model FKf80, capacity 80in. x 30in.

PLANING MACHINES

ORMEROD 24in. Heavy Duty Shaping Machine.

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RYDER - WELLMAN 24in. Travelling Spindle Horizontal Boring Machine.

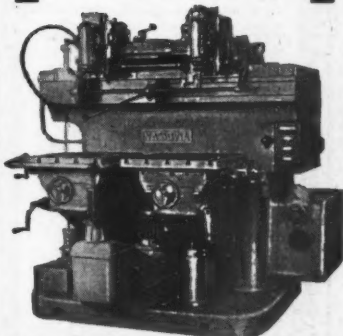
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power feeds to turret.
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slide and turret, power rotating
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AVEY 2-spindle drill, pedestal
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EDGWICK 18 in. traverse, 12 in. x
40 in. table, No. 40 steep taper.
JONES & SHIPMAN duplex slot
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17 MISCELLANEOUS



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- 1 WOLF H. Bender
- 1 DENBIGH No. 2 Fly Press
- 1 HILMOR Bender Lathe
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MATRIX No. 10 x 10in. Plain Thread.

NEWALL 420 Univ. Thread for taps.

HUNT No. 0 and 1 Tap Regrinders.

HUNT No. 0 and 2 Drill.

KEYSEATERS

BENTLEY 5in.

ASQUITH H.K.O. Horiz. Duplex.

EDGWICK 4in.

LATHES

SOUTHBEND 10in. Toolroom.

WILLSON 7 1/2in. S.S. & S.C.

SMART & BROWN Model M S.S. & S.C.

HARRISON 4in. S.S. & S.C.

COLCHESTER TRIUMPH 7in. S.S. & S.C.

SWIFT 12 SV5, facing and boring.

PRATT & WHITNEY 12in. x 30in. S.S. & S.C.

MONARCH 10EE x 22in. S.S. & S.C.

SMALLPIECE 12in. x 20in. Multi-tool.

LORCH A11 Precision.

DENHAM 5in. S.S. & S.C.

RIVETT 3 1/2in. Plain. Model 715.

WARD, HAGGAS & SMITH 8 1/2in. x 78in.

COLTHURST Surfacing and Boring.

RYDERMATIC No. 12 Multi Tool.

MARKING MACHINE

FUNDITOR "Sand Jet."

MILLERS (Horizontal)

DENBIGH Type C4.

ROSCHER EICHLER. Table 39in. x 12in.

SUNDSTRAND No. 0 Production.

PALLAS LM. Table 30in. x 7in.

ST. ANDREA Model UF03.

ADCOCK & SHIPLEY Model OCD.

KENT OWEN 1/8 and 1/14 Production.

HARDINGE Precision.

WERNER. Table 14 x 5.

JONES 225 Univ. Table 22 x 6.

ARCHDALE 28in. and 20in.

MILLERS (Vertical)

C.V.A. 79 Tool and Die.

PALLAS VI. Table 30 x 8 1/2.

REED PRENTICE No. 5, 68in. x 16in. table.

MILNE. Table 30in. x 8in.

WADKIN Type LXIA. Table 36in. x 13in.

PRESSES (Hand)

STANELCO Toggle.

APEX Treadle.

NORTON No. 4.

PRESSES (Power)

LECRAN No. 8, 4 tons.

GERMAN Rotary Pump.

WRIGHT Clipping Press.

SCHULER VZZ, 15 tons d/s gripper feed.

PROFILING MACHINE

CURDNUBE 2 Spindle. Model KIV

RIVETERS

HIGH SPEED Hammer, 7/16 cap.

TURNER RH18 (1/2in.) RH38 (3/4in.)

RH34 (3/4in.).

TURNER RH14/12 (1/2in.), RS6 (3/4in.).

SCREWING MACHINE

ATLAS No. 2, 3in.-6in. (Unused.)

SHAPERS

INVICTA 24in.

NEWLEY 14in.

SLOTTERS

EDGWICK.

BENTLEY 4in.

TAPPERS

ESSEX No. 24, 1/2in. cap.

THIEL No. 4, 1/2-9/32nds.

ACE Horiz., 1/2in. capacity.

HASKINS Type 3 C.A.M., 1/2in. cap.

J & S Electrotap, 1/2in.

THREAD MILLERS

JONES FBI 4ft. between centres.

Herbert No. 4BS Capstan Lathe.

Full Turret Equipment, etc.

Further details from:—

C. & G. OLDFIELD, LTD.,

15, Abercorn Street,

PAISLEY.

Surface Grinder, 24in. x 8in.

Hydraulic Feeds. Built in Diamond

Wheel Dresser. Coolant supply and dust

extraction fitted. Make: Favretto, model

R.P.6. Condition as new.—ROLLS TOOLS,

LTD., No. 1 Factory, Pyrford Road, Pyrford,

Woking, Surrey, or ring Byfleet 43252.

One Secondhand Scrivener No. 1

Centreless Grinding Machine, maximum

capacity 1 1/2in. diameter with Plunge Feed.

Hand Operated. Motorised 400-440/3/50.

C. & G. OLDFIELD, LTD.,

15, Abercorn Street,

PAISLEY.



GILLY AFMF 65

HORIZONTAL BORER

Table type, with travelling spindle, continuous automatic facing head, built-in rotating table, verniers, screwcutting.

Main data:—

Spindle dia. 2 1/2in.
Facing capacity 19 1/2in.
Table surface 35 1/2in. by 28in.
Dist. spindle to outer stay 7 1/2in.
18 spindle speeds 10-1,250 r.p.m.
H.P. motor 7 1/2

INSPECTION INVITED.

Full details from:

SOAG MACHINE TOOLS LTD.*

7, JUXON STREET, LAMBETH, S.E.11

*Phone: RELiance 7201

*Grams: Soolsag, London

B.E.N. Air Compressor Unit

for sale. Comprising type A3 single

cylinder vertical air cooled compressor, motor

driven, 400-440/3/50. Displacement 20.7 c.f.m.

Working pressure 80 lb. p.s.i. Air receiver 15in.

diameter x 40in. high. All mounted on steel

baseplate.—F. J. EDWARDS LIMITED, 359

Euston Road, London, N.W.1, or 41, Water

Street, Birmingham, 3.

Wickman Spark Erosion Ma-

chine, 400/3/50.—A. McNAMARA &

CO., LTD., New Line, Bacup, Lancs. *Phone:

Bacup 946.

Index 24 Automatic, Motorised,

barfeed, gears, etc., good condition, also

B.S.A. 1/2in. similar, mooting att.—C. L.

THOMAS, LTD., Stirling Road, Solihull 3075-6.

When answering advertisements kindly mention MACHINERY.

Classified Advertisements (PLANT FOR SALE, contd.)

RING BELLS for machine tools

LEEDS 63-7398

No. 16 Herbert Vertical Milling Machine. Table 55in. x 13in. Long traverse 34in. 16 speeds 16-427 r.p.m. S.C. motor.

No. 2 Edwicks Vertical Milling Machine with power operated rotary table. Table 46in. x 11in., long, traverse 20in. Spindle bored No. 40 S.M.T. 5 h.p. 400/3/50 motor, 9 speeds 37-605 r.p.m.—LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

Edwards

TAYLOR & CHALLEN Type B34 Open Fronted Upright Power Press. With double left to right roll feed. Pressure exerted approx. 6 tons. Stroke 2in. Bed 15in. x 11in. Hole in bed 7in. diameter. Weight approx. 11 cwt.

BESCO Model APX Eccentric Power Punching Press. Pressure exerted approx. 8 tons. Stroke adjustable from 4in. to 14in. Bed 11in. x 8in. Hole in bed 4in. x 3in. On cast iron table stand.

CRAIG & DONALD 8/35 Double Sided Geared Single Action Power Press. Tie bar construction. Motorised for 400-440/3/50 supply. Capacity 255 tons. Stroke of ram 12in. Between uprights 35in. Hole in bed 29in. diameter.

TAYLOR & CHALLEN Double Sided Double Action Cam Action Drawing Press. Can be supplied motorised for 400/440/3/50 supply. Punch stroke 8in. Blankholder stroke 4in. Between uprights 20in. Bed 18in. x 15in. Hole in bed 8in. diameter. Weight approx. 45 cwt.

BESCO Eccentric Power Punching Press. Motorised for 400-440/3/50 supply. Pressure exerted approx. 8 tons. Stroke adjustable from 4in. to 14in. Bed 11in. x 8in. Hole in bed 4in. x 3in. Weight approx. 720 lb.

BLISS No. 220 Inclinable Automatic Strip Feed Power Press. Complete with self-contained vacuum pump to strip feed. Pressure exerted approx. 20 tons. Stroke 3in. Bed 20in. x 13in. Hole in bed 8in. diameter. Width of strip variable from 2in. to 5in. Weight approx. 35 cwt.

HORDERN, MASON & EDWARDS Type BX24 Open Fronted Upright Geared Power Press. With single left to right roll feed. Motorised for 400/3/50 supply. Pressure exerted approx. 20 tons. Stroke 2in. Tee slotted bed 24in. x 19in. Hole in bed 10in. diameter. Length of feed available from 0in. to 6in. Weight approx. 25 cwt.

Photographs of the above are available.

VERY FAVOURABLE HIRE PURCHASE TERMS CAN BE OBTAINED.

MACHINE TOOLS, NEW AND USED, Of Every Description. Attractive Prices.

F. J. EDWARDS LTD.,
359-361, EUSTON RD., LONDON, N.W.1

Telephone: EUSTON 5000. Telex 24264.

And at Lansdowne House, 41, Water St., Birmingham, 3. Telephone: Central 7606-8

Lang 84in. S.S. & S.C. Centre
Lathe taking 5ft. 0in. between Centres. Complete with 2 Speed Motor giving 16 Spindle Speeds, Taper Turning Attachment. Excellent condition.

Further details from:—

C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

When answering advertisements kindly mention MACHINERY.

Immediate delivery. New Induma Model 5u Universal Milling Machine, table 79 in. by 16 in., 18 spindle speeds 25-1,520 r.p.m.

GATE MACHINERY CO. LTD.
172-178, Victoria Road,
Acton, London, W.3.
Telephone: ACOrn 8881

Weatherley Oilgear 12 Ton Vertical broaching M/c. 30in. str. Hydraulic, steel frame, Mot. suds, Good cond.—C. L. THOMAS, LTD., Stirling Road, Solihull 3075-6.

Stanley 104in. x 8ft. Sliding Bed
Lathe. Swing 48in. in cap. Full equipment. 1957 machine.—BOX C703, MACHINERY, Clifton House, Euston Road, N.W.1

Newall No. 1 Jig Borer—Very
Little used—with temperature controlled sectional housing.—SCOTT ENGINEERING (BOURNEMOUTH), LTD., 68, Old Wareham Road, Parkstone, Poole, Dorset. Parkstone 4455/6.

Holroyd 2 Spindle Vertical Profile Miller. 400/3/50 motors. Table 18in. x 14in. Speeds to 3,000 r.p.m.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARK 2333.

MISCELLANEOUS FOR SALE

14in. Heavy Duty Rotary Milling
Table, weight approx. 180 lb., condition very good 465. 14in. Black & Decker Drills heavy duty with stand 110 volt and 230 volt £20. Surface Plates 24in. x 36in. New £15. 12in. x 8in. New 50s., 20in. to 24in. Micro-meters Moore and Wright new in box £22. Large Taper Shank H.S.S. drills, sets of four adjustable faceplate jaws weight 56 lb. £12 per set, Roller Conveyor good secondhand 55s. A Length. New Eveready & Vignoles Meggers 500V. £22 10s. 0d. Factory type sack Barrows 50s. New Milne Welding Torches with 11 Nozzles £4 5s. 0d. New Ex W.D. Green Tarapalms 18ft. x 15ft. weight 56 lb. £10. 6in. Portable Grinders H.D. new £20. Milling Cutters, Involute Gear Cutters, Dies for Herbert Dieheads, files, lathe tools, angle plates, etc. Send for detailed lists to: G. J. PAGE, LTD., 135, Green Lane Road, Leicester. Tel. 68863.

**CLOSING DATE FOR
"CLASSIFIED"
ADVERTISEMENTS
WEDNESDAY!
PRECEDING ISSUE
DATE.**

AUCTIONS

SHIRLAW, ALLAN & CO.,
AUCTIONEERS, HAMILTON.

JOHN McNEILL & CO. LTD. (In Creditors Voluntary Liquidation).

IMPORTANT THREE-DAYS' SALE OF HEAVY ENGINEERING PLANT AND MACHINERY, OVERHEAD ELECTRIC CRANES AND RUNWAYS, WEIGHBRIDGE, STEEL-FRAMED AND WOODEN BUILDINGS, A.C. and D.C. MOTORS, WELDING PLANT, WOOD-WORKING MACHINE TOOLS, HORZ. STEAM BOILER, UNIT HEATERS, SMALL TOOLS and INSPECTION EQUIPMENT, CONSUMABLE STORES, SCRAP MATERIALS OFFICE EQUIPMENT, ETC.

AT COLONIAL IRON WORKS, 80 HELEN STREET, GOVAN, GLASGOW, S.W.1, ON TUESDAY, 14th, WEDNESDAY, 15th and THURSDAY, 16th MARCH, 1961, AT 10.30 A.M. EACH DAY.

SHIRLAW, ALLAN & CO., AUCTIONEERS HAMILTON, have received instructions from James Gibson, Esq. (Messrs. Aikman & Glen), C.A., 121 St. Vincent Street, Glasgow, Liquidator of above Company, to Sell, by Auction, as above, ON VIEW SEVEN DAYS PRIOR TO SALE. CATALOGUES, IN COURSE OF PREPARATION FROM AUCTIONEERS, HAMILTON, FEBRUARY, 1961.

FORTY-EIGHTH SALE



By Order of the Secretary of State for War
WAR DEPARTMENT STORAGE DEPOT,
RUDDINGTON
(Five miles south of Nottingham on the main Nottingham-Loughborough Road)

WALKER, WALTON & HANSON
(In association with TURNER, FLETCHER & ESSEX and RICHARDSON & LINNELL)
will SELL BY AUCTION on

MONDAY and TUESDAY,
13th and 14th MARCH, 1961,
at 10.30 a.m. each day

**A Large Quantity of
GOVERNMENT
SURPLUS PLANT AND STORES
MACHINE TOOLS, Etc.**
including:

Capstan and Turret Lathes, Bliss Presses, Electric Welders, etc., 36 Skid Mounted Diesel Engines, 4,100 Canvas Covers and Canopies, 3,900 6 and 12 Volt Batteries Tubular Steel Canteen Furniture, 3,300 Tyres, Tubes and Wheels, C.A.V. and Lockheed Spares, Armatures, Dynamos, Carburettor and Fuel Pump Spares, Bilge Pumps, Electronic Valves, Sparking Plugs, Auxiliary Charging Sets, Towing Ambulances, Towing Ropes, Tool Bags, Hydraulic and Screw Jacks and other M.T. Spares, 9,450 glass. Wax Protective Solution, Textiles, Buttons, Cottons, Thread, Clothing, Footwear, Haversacks, etc., also

535 VEHICLES AND MOTOR CYCLES
including:

Mobile Workshops (fitted with Lathes, Drilling Machines, Generating Sets, etc.), Petrol and Water Tankers, 200-800 galls., Trailers 10 cwt.-1 ton, Load Carriers 1-7 tons Petrol and Diesel, Austin "Champs", B.S.A. and Matchless Motor Cycles, etc.

FOR VIEWING DATES AND TIMES SEE PAGE VIII IN THE CATALOGUE.

CATALOGUES: Price is, each (P.O.'s only) to admit TWO PERSONS to View and ONE PERSON to the Sale may be obtained from the Auctioneers' Offices, Dept. 4, Byard Lane, Bridesmith Gate, Nottingham, from 27th February onwards. Tel.: Nottingham 54272 (7 lines).

Classified Advertisements (PLANT FOR SALE, contd.)

On the instructions of the Liquidators E. R. NICHOLSON, Esq., F.C.A., and ARTHUR T. EAVES, Esq., F.C.A., re:—

VACTRIC (Manufacturing) LTD.
(in creditors voluntary liquidation).

G. F. SINGLETON & CO.

will offer for SALE BY AUCTION, on the premises, on WEDNESDAY, 15th MARCH, 1961, at 11 a.m. prompt (subject to conditions of sale and unless previously sold by private treaty) the

MODERN FREEHOLD SINGLE STOREY FACTORY BOLTON, Lancs.

ALSO THE
MODERN SHEET METAL MACHINERY,
MACHINE TOOLS, POWER PRESSES,
SPRAYING & ASSEMBLY PLANT,
VALUABLE OFFICE & WORKS EQUIPMENT
(as previously advertised)

The Lots may be inspected between 10 a.m. and 4 p.m. on 1st/3rd, 6th/10th and 13th/14th March, 1961, or by appointment with the Auctioneers. Particulars of the premises and catalogues of the plant may be obtained from G. F. SINGLETON & CO., Industrial Auctioneers and Estate Agents, 9 Richmond Terrace, BLACKBURN (Tel. 7722/3) and Lloyds Bank Buildings, 53 King Street, MANCHESTER 2 (Tel.: DEAnsgate 7954/8) or from the Liquidators, E. R. NICHOLSON Esq., F.C.A., Messrs. Peat, Marwick, Mitchell & Co., 11 Ironmonger Lane, London, E.C.2 (Tel.: MONarch 8888) and Vactric House, Sloane Street, London, S.W.1 (Tel.: BELgravia 7000) or ARTHUR T. EAVES Esq., F.C.A., Messrs. Harry L. Price & Co., 47 Mosley Street, Manchester 2 (Tel.: CENTral 1905) or from the Solicitors, Messrs. GODDEN HOLME & CO., 5 Upper Belgrave Street, London, S.W.1.

By Order of the Liquidator, H. W. PITT, Esq., F.C.A.
Re: Berkeley Coachworks (Sales & Export) Ltd.
**HITCHIN STREET.
BIGGLESWADE, BEDS.**

HENRY BUTCHER & CO.,

are instructed to offer for SALE BY AUCTION, in LOTS, at the WORKS on TUESDAY, 11th APRIL, 1961, AND FOLLOWING DAYS at ELEVEN A.M. EACH DAY the

PLANT, MACHINERY, BERKELEY CARS AND SPARES, TIMBER, CARAVANS AND EQUIPMENT

including:
"EDWARDS" SR. and 4ft. POWER
GUILLOTINES
SWING BRAM FOLDERS AND
BENDING ROLLS
S.S. & R.C. LATHE
DRILLING AND GRINDING MACHINES
STRAIGHT LINE EDGERS
DOVE TAILERS
BAND, CIRCULAR and CROSS CUT SAWS
ROUTERS, SPINDLE MOULDERS
Screw Fit Presses, Circle Cutters,
Riveters, Tapping Machines,
Portable Electric Tools
UNIVERSAL WOODWORKERS
PLANING MACHINES
AIR COMPRESSORS
WELDING PLANTS and SPOT WELDERS
"BERKELEY" SPORTS CARS, JIGS
and MOULDS
COMPREHENSIVE RANGE OF MOTOR
SPARES and ACCESSORIES
SEVERAL TONS ALUMINIUM and STEEL
STOCK OF CARAVANS,
CHASSIS and PARTS
STOCK OF TIMBER, PLYWOOD AND
FORMICA
OFFICE FURNITURE and DRAWING
OFFICE EQUIPMENT

Catalogues (when ready), price 1s. each, may be obtained of:

Messrs. ALFRED TOOKE & CO., Chartered Accountants, 100 Park Street, Grosvenor Square, London, W.1, and of

Messrs. HENRY BUTCHER & CO., 73 Chancery Lane, London, W.C.2. Telephone: HOLborn 5411 (8 lines).

SITUATIONS VACANT

If you do not wish your reply to any Box No. advertisement in this section to be forwarded to certain firms, please advise us. Your reply will then be destroyed, but you will not be notified as this would disclose the identity of the advertiser.

Factory Foreman. Good All
round man with experience of wood and metal shop production required by old established Company. Write details of age, exp. and sal.—BOX C682, MACHINERY, Clifton House, Euston Road, N.W.1.

Production Controller Experi-
enced in Light Production Engineering, knowledge of Machine Shop, Sheet Metal Work and processing an advantage. Interesting position with good salary plus bonus, plus super-annuation.—Application listing experience to Works Director, J.W.B. ENGINEERS, LTD., Lower Road, Chalfont St. Peter, Bucks.

Machine Shop Foreman—Man
with initiative required to run a small Machine Shop using Ward capstans and C.V.A. Automatics. Applicants must be capable of setting both types of machines and planning own production runs. This is a staff position and wages will be decided on experience and ability.—Write or telephone R. A. STEPHEN & CO., LTD., 120-126, Lavender Avenue, Mitcham, Mitcham 1668.

Highly Paid, Secure and Interest-
ing posts are always available for technically trained men. Find out how you can put some letters after your name by preparing at home on "No Pass—No Fee" terms, A.M.I. Mech.E., A.M.I. Prod.E., A.M.S.E., City and Guilds, etc. Full details of exams and hundreds of courses in all branches of Engineering, Draughtsmanship, Management and Automation Techniques, the benefits of our Employment Dept., and unique record of 95 per cent. successes are given in "Engineering Opportunities"—a valuable 148-page Guide which will reveal many chances you are now missing.—Write for your copy today (stating subject of interest)—FREE and without obligation, B.I.E.T. (Dept. 43a), 29, Wright's Lane, London, W.8.

Technical Sales Manager for
Midlands area required by Machine Tool Company having branch office and showroom. Experience in similar position preferred.—Send details in confidence to PERSONNEL MANAGER, BOX C639, MACHINERY, Clifton House, Euston Road, N.W.1.

Foreman, Working, Required for
small progressive specialist production engineers, 15 miles south of Birmingham, employing 20 people.

Must be good disciplinarian, tactful, and have first rate knowledge of single spindle automatics, and Landis dieheads. Position carries good rate, staff status, and is pensionable.

Write, stating age, full experience, present salary, etc.—BOX C642, MACHINERY, Clifton House, Euston Road, N.W.1.

Ministry of Aviation require
ASSISTANT TECHNICAL COSTS OFFICERS for posts based in Central London and Nottingham, S.E.9, to prepare estimates of prime costs of manufacture of engineering productions. Considerable travelling. QUALS: Recognised eng. apprenticeship or equiv. O.N.C., C & G. Final Certs. or equiv. Good exp. in rate-fixing, planning and prime cost estimating.

Machine shop exp. an advantage. Vacancies in sections dealing with high class mechanical and electrical eng. productions—aircraft, instruments, electronic design. SALARY: £1,014-£1,158. Good prospects for promotion and pension.—Application forms from MANAGER (PE 2530), MINISTRY OF LABOUR, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4.

When answering advertisements kindly mention MACHINERY.

There is a vacancy for a
Development Engineer
 in our
**PRODUCTION ENGINEERING
 DEPARTMENT**

We are looking for a man of initiative, capable of original, creative ideas, whose duties are to investigate existing methods of production with a view to reducing costs and to design (schematically) and develop new equipment to achieve this aim.

Age 24-36, with at least H.N.C. Mech. or Prod. Engineering. Indentured apprentice or similar might suit. Design and development experience of prototype special purpose equipment desirable. Experience of pneumatic or hydraulic circuitry an advantage.

Apply, quoting Ref. AH/30, to the Staff Manager

**The Morgan Crucible Company
 Limited,
 Battersea Church Road, S.W.11**

Senior Foreman

Rapidly expanding Rubber Company require to fill a senior Staff position of Engineering/Tool Room Superintendent at its Works in Tottenham, London, N.17.

Applications are invited from Engineers holding similar positions and with first class Workshop experience of mould manufacture and medium weight general engineering.

The post calls for a person between the ages 30-45 years, able to work on own initiative and capable of introducing and applying Modern Production Methods. We are willing to pay a top salary to a man of proven ability.

Apply—

**THE CANNON RUBBER
 MANFRS. LTD.
 ASHLEY ROAD,
 TOTTENHAM, N.17**

Young Man Required, Having
 completed the Junior Technical School day course in Engineering to train as a Draughtsman, particularly in connection with press tool work. Give details of education and experience to date, if any.—**BOX C865, MACHINERY, Clifton House, Euston Road, N.W.1.**

Practical Engineer Required to
 take charge of production of small precision machine shop, N.E. London. Top paid job.—**Apply BOX C868, MACHINERY, Clifton House, Euston Road, N.W.1.**

SCHULER PRESSES

TECHNICAL ASSISTANT To DIRECTOR

Applications are invited from suitably qualified engineers, age 28-40, for this important and progressive appointment in the new English Company.

The post requires a practical familiarity with presses and presswork and some commercial experience. In addition, some experience of engineering sub-contracting and a knowledge of German would be advantageous.

Written applications with full personal details and experience to date should be addressed to:—

**The Technical Director,
 Schuler Presses,
 P.O. Box 51, Coventry.**

Applications should be marked 'Confidential' and will be so treated

AUTOS

Medium size progressive Company require CAM DESIGNER for B. & S. etc. machines, experienced on multi's an advantage but not essential. Willing to complete cams on miller. State experience, wages required. Age no objection if active. All answered. **BOX C485, MACHINERY, Clifton House, Euston Road, N.W.1.**

DIE DESIGNER FOR PRESSURE DIE CASTING

An Excellent Opportunity
 occurs for experienced die casting Designer to join an old established Company with progressive expansion programme.

Applicants must have experience on pressure dies for aluminium and zinc. This should have covered a wide range of modern plant, together with practical understanding of production problems. Qualifications: H.N.C. or equivalent.

The factory is situated in a pleasant part of the Midlands. Life Assurance and Contributory Pension Scheme in operation. Excellent conditions, sports and welfare facilities.

Salary commensurate with experience and qualifications.

Written applications with full particulars should be addressed to:—

**THE ESTABLISHMENTS OFFICER,
 METAL CASTINGS LIMITED,
 Droitwich Road,
 Worcester.**

Machine Shop Foreman Required
 for small precision engineering factory, North London. All-Round mechanic offered well-paid job.—**Apply BOX C870, MACHINERY, Clifton House, Euston Road, N.W.1.**

LIGHT COIL SPRINGS WORKS MANAGER

Works Manager required to take charge of light coil spring shop employing 200 people in the Newcastle-on-Tyne area. Experience of coil spring and press work more important than age, and the right man will be paid an appropriate salary. Write **BOX C 696, MACHINERY, Clifton House, Euston Road, N.W.1.**

Foreman with Good Mechanical
 engineering background required by Company manufacturing Printed Circuits in Tolworth area. Experience of setting and working to close limits essential. Superb pension scheme—Write giving full details of experience, age and salary required to **BOX Fw 4889, A.K. ADVG., 212A, Shaftesbury Avenue, London, W.C.2.**

Automatic Machine Tool Setter,
 fully skilled for B & S OOG High Speed section, very high rate offered to 1st class man plus excellent production bonus, small self-contained unfurnished flat adjoining factory at low rental.—**TIMMINS & CO., LTD., Wellington Street, Slough.**

When answering advertisements kindly mention MACHINERY.

Classified Advertisements (SITUATIONS VACANT, contd.)

REPRESENTATIVES

Machine Tool Sales Representative

A vacancy exists in the London and Home Counties area for a Representative with experience of selling high quality Machine Tools.

We handle a wide range of makes and types including those manufactured by our Associate Company, Coventry Gauge & Tool Co. Ltd.

Exact area to be covered is subject to discussion with successful applicant.

Non-contributory Pension Scheme in operation after qualifying period.

Please write to:

ROCKWELL MACHINE TOOL CO., LTD.

Welsh Harp, Edgware Road,
London, N.W.2

TECHNICAL REPRESENTATIVE

Required by well known Tool Manufacturers to cover part of London and the South Eastern Counties.

Preferably in the 23-30 age group, resident within the territory, and with an engineering background.

An attractive salary will be paid, a contributory Pension Scheme is in operation, and a Company car will be provided.

Some Continental travel may be involved, and therefore a knowledge of French and/or German would be an asset.

This is an admirable opportunity for someone with intelligence, and who is fond of hard work, to obtain a permanent position with real prospects of advancement.

Apply giving details of age, previous experience and salary to

BOX C.680 MACHINERY,
Clifton House, Euston Road, N.W.1

Old Established Machine Tool

Merchants with reputable agencies and handling new machines only require two experienced representatives with connections to operate London area. Salary, commission, expenses. Car provided.—Write in confidence, BOX C647, MACHINERY, Clifton House, Euston Road, N.W.1.

Technical Representative Re-

quired for the sale of Forging Machines. For well established Midlands Machine Tool Agents.—Please write giving full details of experience, salary required, etc., to BOX C697, MACHINERY, Clifton House, Euston Road, N.W.1.

Technical Representative/Ser-

vice Engineer required by leading North of England machine tool merchants. Fully conversant with all types of machine tools normally used in toolroom and production shops. Preferably resident in the Merseyside area. Transport provided; excellent pension scheme in operation.—Apply with full details experience to date, etc., to BOX C691, MACHINERY, Clifton House, Euston Road, N.W.1.

First Class Machine Tool Repre-

sentative required in the Coventry area, must be conversant with all types of machines. Good salary and permanent position to right applicant.—Please apply in confidence to BOX C681, MACHINERY, Clifton House, Euston Road, N.W.1.

SITUATIONS WANTED

Senior Executive Desires Posi-

tion of trust and responsibility. Fully experienced general administration of both office and works, purchasing, commercial management, etc. Particularly interested in assisting build, develop and expand and can offer hard work, initiative and utmost loyalty. Age 45 years.—BOX C589, MACHINERY, Clifton House, Euston Road, N.W.1.

Manager, 40, Desiring Change,

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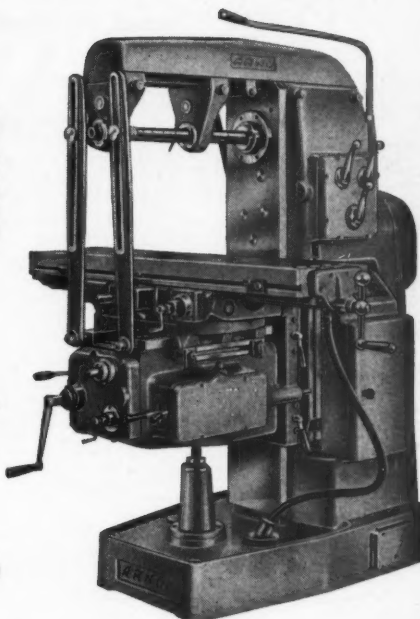
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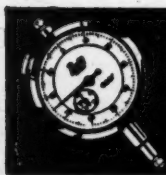
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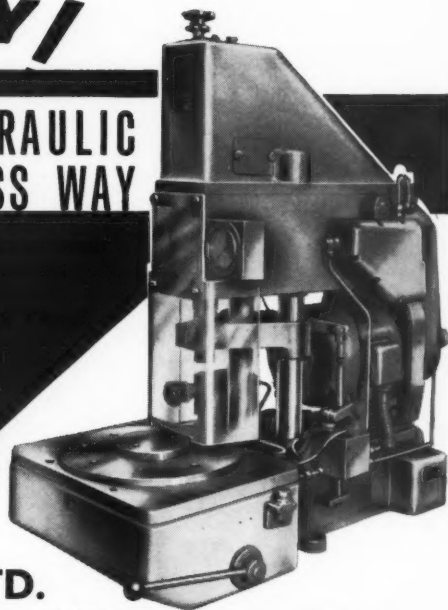
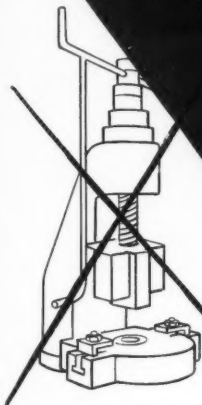


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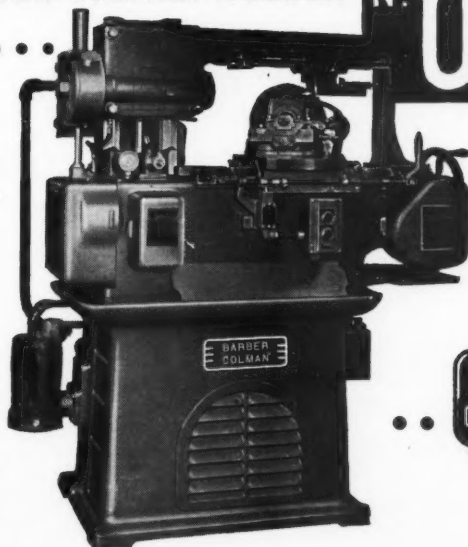
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